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Committee on Energy and Utilities

Representative Chuck Benedict

December 18, 2007

I would like to thank Chair Montgomery for holding this hearing on AB 346 which essentially lifts the 25-year-old state-wide moratorium on building new nuclear power plants in Wisconsin. I would also like to thank him for chairing, and the Joint Legislative Council for establishing, the Special Committee on Nuclear Power on which I was privileged to serve from September 2006 to January 2007. The committee came up with a number of recommendations which have now materialized as AB 346, 347, and 348. I will focus my comments on AB346, the lifting of the moratorium on new nuclear power plants, a bill which I oppose.

The moratorium became Wisconsin law in 1983 in the wake of the Three Mile Island nuclear plant meltdown of 1979. This law states that no new nuclear power plants are to be built in Wisconsin unless two conditions are fulfilled:

- 1) Any new nuclear power facility built in Wisconsin must be economically advantageous to ratepayers compared to feasible alternatives, and
- 2) That a federally licensed repository for high-level nuclear waste is operating with enough capacity to handle the waste from all nuclear power plants in Wisconsin.

Neither of these conditions has been fulfilled, nor are they likely to be so in the foreseeable future.

The proponents for building new nuclear plants have not come up with solutions to these problems of cost and waste, so they are now attempting to change the laws and obtain federal subsidies and guarantees to build new nuclear power plants in Wisconsin. I think that this is, at best, a short-term fix which we will learn to regret later.

Believe me, I am well aware of the challenges of our increasing energy needs, the dangers of CO2 and other emissions, and the problems of global warming. We are heading for a crisis, if we are not there already. A crisis, however, presents both danger and opportunity. While on the Special Committee on Nuclear Power, I learned much about the dangers and problems of nuclear, coal, and other energy sources. But, I also learned that we have viable, cleaner, often renewable alternatives.

THE HISTORY OF THE
REPUBLIC OF THE UNITED STATES
OF AMERICA

The history of the United States of America is a story of a people who have grown from a small colony of English settlers to a great nation. The story begins with the first English settlers in 1607, who came to the New World to seek a better life. They found a land of opportunity, but also a land of hardship. The settlers had to learn to survive in a new environment, and they did so by working together and by the help of the Native Americans.

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Let us move our energy policy into the 21st century, beyond the outdated, unsafe, and expensive nuclear option. Let us use our technical skill, our entrepreneurial ingenuity, and our cooperative hard work to solve our energy needs in a safe and sustainable fashion. Let us protect our resources from further fruitless pursuit of nuclear power and invest them instead in the more promising alternatives of clean-coal fired plants with carbon capture and sequestration, solar power which has made strides in both Germany and the southwestern states, geothermal, wind, and tidal energy. These are the directions I believe we should pursue for our future energy needs so that we can leave a greener Earth to our children and grandchildren, and still maintain economic prosperity.

And, on the personal level, we can each make our own contribution by turning off lights, turning down the thermostat, driving a fuel efficient vehicle, driving it less, and supporting public transportation when feasible. Or, more simply, remember the three R's: reduce, reuse, and recycle.

I would be happy to take comments or questions.

To the Assembly Energy and Utilities Committee
Dec. 18, 2007
From John LaForge
Nukewatch staff
P.O. BOX 649, Luck, Wisconsin 54853; 715-472-4185

* According to the research by the Medical University of South Carolina, leukemia rates in children are elevated near nuclear facilities. Death rates for children up to age 9 were elevated between 5 and 2 percent depending on their proximity to the reactors. Leukemia incidence rates were increased by 14 to 21 percent in children up to age 9, and 7 to 10 percent for those up to age 25. Childhood exposure and parental exposure to radiation emissions were named as possible causes of these cancers and premature deaths. (Peter Baker, *European Journal of Cancer Care*, July '07.)

* According to the *Archives of Environmental Health* local infant mortality and childhood cancer rates dropped dramatically following the closure of eight U.S. nuclear reactors. The research of infant mortality rates there was a 17.4 percent drop in infant mortality in the two years following the reactors' closure in counties lying up to 40 miles downwind of nuclear reactors. New York State Assemblyman Richard Brodsky said of this study, "We finally have peer-reviewed accurate data attaching nuclear power reactors to death and injury in the host communities." (Gould, Manganos, et al, 2002)

Rep. Edward Markey, D-Massachusetts, a senior member of the House Energy and Commerce Committee, in a **Feb. 18, 2005** letter to the Nuclear Regulatory Commission regarding health risks for communities close to nuclear reactors, said "The nuclear industry and the NRC have automatically dismissed all studies that link increased cancer risk to exposure to low levels of radiation," Rep. Markey said. Markey's letter concluded, "The NRC needs to study — not summarily dismiss — the connection between serious health risks and radiation released from nuclear reactors. I am urging the agency to investigate these risks and I will continue to closely monitor the NRC's progress."

* A new study by Joseph Mangano *International Journal of Health Services*, March, 2006. The paper shows that near the Brookhaven (NY), Indian Point (NY) and Oyster Creek (NJ) nuclear plants, trends in Strontium-90 in baby teeth and childhood cancer incidence were similar. With several hundred teeth and cancer cases used near each plant, the findings are highly significant. This research suggests a cause-and-effect link between radioactivity from reactors and cancer in local children.

* All official U.S. government assessments conclude that every radiation dose can potentially cause cancer:

U.S. Environmental Protection Agency, EPA, "...any exposure to radiation (...can increase the risk of cancer)....no radiation exposure is completely risk free ... any exposure to radiation poses some risk..."

U.S. Department of Energy, About low levels of radiation "... the major effect is a very slight increase in cancer risk."

U.S. Nuclear Regulatory Commission, "[T]he radiation protection community conservatively assumes that any amount of radiation may pose some risk for causing cancer ... any increase in dose, no matter how small, results in an incremental increase in risk."

National Academy of Sciences (BEIR VII), "There appears to be no threshold below which exposure can be viewed as harmless."

U.S. National Council on Radiation Protection, "... every increment of radiation exposure produces an incremental increase in the risk of cancer."

* Just last month a study done for Detroit Edison, Honeywell, Pacific Gas & Electric and Shell, found that the U.S. Could Cut 28% of Greenhouse Gases & Save Money. Using existing efficiency techniques and tax incentives, the report found, this huge pollution reduction could pay for itself — both in industry and individual households — in lower utility bills.

* Mr. Chariman, this committee should be looking into the health hazards posed by radiation emitted from operating reactors. It should not be promoting the expansion of radioactive pollution that AB346 would allow.

* Along with other materials, I have for each of you a list of 12 studies showing that nuclear reactors cannot not reduce carbon emissions but only make them worse. Please vote against passage of AB 346.

Thanks you,
John LaForge

REFERENCES:

*** *EUROPEAN JOURNAL OF CANCER CARE*, July 2007, Vol. 16, Issue 4, 355–363**

"Meta-analysis of standardized incidence and mortality rates of childhood leukemia in proximity to nuclear facilities," <www.blackwell-synergy.com/doi/abs/10.1111/j.1365-2354.2007.00679.x>

By Peter J. Baker, Department of Biometry and Epidemiology at the Medical University of South Carolina, 933 Mayberry Road, Gulph Mills, PA 19428, (E-mail: pjbaker@alumni.musc.edu).

Abstract: The meta-analysis combined and statistically analyzed studies of childhood leukemia and nuclear facilities. ... Caution must be used when interpreting these results. The meta-analysis was able to show an increase in childhood leukemia near nuclear facilities, but does not support a hypothesis to explain the excess....

*** *ARCHIVES OF ENVIRONMENTAL HEALTH*, VOL. 57, NO.1; JAN.-FEB. 2002**

"Infant Death and Childhood Cancer Reductions after Nuclear Plant Closing in the United States," <<http://www.insp.mx/biblio/alerta/al0302/08.pdf>>

By Joseph J. Mangano, Jay M. Gould, Ernest J. Sternglass, Janette D. Sherman, Jerry Brown, William McDonnell, p. 23.

*** *INTERNATIONAL JOURNAL OF HEALTH SERVICES*, VOL. 30, NO. 3, 2000**

"Strontium-90 in Deciduous Teeth as a Factor in Early Childhood Cancer,"

<<http://www.insp.mx/biblio/alerta/al1000/39.pdf>>

By Jay M. Gould, Ernest J. Sternglass, Janette D. Sherman, Jerry Brown, William McDonnell, and Joseph J. Mangano, p. 515.

*** *Rep. Markey: Study Suggests Infant Mortality Associated With Radiation From Reactors, Questions NRC on Health Risks of Living Near Reactors***

Washington, DC — Rep. Edward Markey, D-Massachusetts, a senior member of the House Energy and Commerce Committee, the panel which oversees nuclear power regulation, released a letter Feb. 18, 2005 he sent to the Nuclear Regulatory Commission (NRC) regarding health risks for communities close

to nuclear reactors. A new study by Dr. Ernest Sternglass of the University of Pittsburgh suggests that infant mortality increased significantly in 2002, after operating capacity at 104 nuclear power stations reached its highest level.

"The nuclear industry and the NRC have automatically dismissed all studies that link increased cancer risk to exposure to low levels of radiation," Rep. Markey said. "The reality is that the data suggest that we should be taking this potential linkage much more seriously."

Rep. Markey's letter to the NRC was motivated by the ordeals of the Sauer family, former residents of Minooka, Illinois, which is located close to the three Dresden power reactors. The family recently relocated because of concerns about the health impacts associated with living near the Dresden site, which were heightened because of their daughter's brain cancer.

In June 2003, the NRC was presented with data obtained from the Illinois Department of Public Health (IDPH) that indicate that in Grundy County between 1995-99, the infant mortality rate doubled and there has been a nearly 400% increase in pediatric cancer. In the same period, there has been a 38% increase in cancer among those aged 28-44 years old (while the same statistic for all of Illinois decreased by 8%). Moreover, other statistics show that the incidence of leukemia was 50% higher in men and 100% higher in women in Grundy County than it was in the rest of Illinois. In its responses to the Sauers, NRC personnel ignored these statistics and instead cited a 1990 National Cancer Institute study entitled "Cancer in Populations Living Near Nuclear Facilities," which has numerous flaws in design, since, as the authors themselves stated, the limitations in the study were accepted so that, "it could be completed in a time frame that was relatively short for a survey of such magnitude."

In addition to the Sauer case, Rep. Markey's office has been made aware of additional studies and data:

- * On Feb. 18, Dr. Ernest Sternglass released data at the American Association for the Advancement of Science meeting in Washington, DC indicating a spike in infant mortality that occurred in 2002, coming after operating capacity at 104 U.S. reactors reached its highest levels, and increased at the highest rate, between 1997 and 2001. His work also refers to a scientific paper indicating that low level radiation exposure during pregnancy is directly related to low birth weight which — in addition to infant mortality — has been implicated in numerous chronic diseases, including autism, asthma, cognitive dysfunction, rheumatoid arthritis, anemia, obesity, heart disease and cancer.

- * A 2003 article by Joseph Mangano *et al* in *Archives of Environmental Health* found elevated levels of childhood cancers in populations living within 30 miles of nuclear reactors between 1988 and 1997. For example, in Plymouth County, Mass. (near the Pilgrim Power reactor), there was found to be a 14.6 percent increase in the numbers of childhood cancers as compared to the rest of the country. And in Essex County, Mass. and Rockingham County, New Hampshire (near the Seabrook Power reactor), there was found to be a 24.8% increase in the number of childhood cancer mortalities.

Rep. Markey's letter concluded, "The NRC needs to study — not summarily dismiss — the connection between serious health risks and radiation released from nuclear reactors. I am urging the agency to investigate these risks and I will continue to closely monitor the NRC's progress."

For a copy of Rep. Markey's letter to the NRC please see www.house.gov/markey

Infant mortality rates drop around five US nuclear power reactors after reactors closed

4 May 2000, By Danielle Knight

WASHINGTON, Apr. 26 (IPS) — Infant mortality rates around five U.S. nuclear power reactors dropped almost immediately after the reactors closed, according to a new study released Wednesday on the 14th anniversary of the Chernobyl nuclear disaster. Raising questions whether allowable emissions of "low-level" radiation from nuclear plants endanger nearby residents, the study has prompted calls for the U.S. government to begin considering adverse health effects associated with nuclear plants before renewing their operating licenses.

The study was conducted by the New York-based Radiation and Public Health Project and published in spring edition of "Environmental Epidemiology and Toxicology", a scientific journal.

Joseph Mangano, the author of the study and a research associate at the Project, says it is the first to document improvements in health after a nuclear plant closes and supports other studies showing elevated childhood cancer near operating reactors. "However, the Nuclear Regulatory Commission (NRC), utilities and public health departments have never voluntarily performed a single study on cancer or other radiation-induced conditions," he says.

Using public health statistics published by the government, Mangano examined infant death rates in counties within 50 miles and in the prevailing wind -or "downwind" - direction of five reactors across the United States. In the first two years after the reactors closed, infant death rates fell 15 to 20 percent from the previous two years, compared to an average U.S. decline of only six percent between 1985 and 1996.

In each of the five areas studied, no other nuclear reactor operated within 70 miles of the closed reactor, essentially creating a "nuclear-free zone," says Mangano.

The study also details the fall in newly diagnosed leukemia and cancer cases and birth defect deaths in children under five years in the four-county local area downwind from the Rancho Seco reactor, near the metropolitan area of Sacramento, California. Mangano says this decline has continued through the first seven years after the June 1989 closing. In contrast, the local infant death rate rose in the two years after Rancho Seco began operations in 1974.

Mangano says in addition to the regions surrounding the five reactors in the study, he has recently found dramatic decreases in infant mortality rates near two reactors that closed in 1997. In communities near the Big Rock Point reactor in Michigan, the percentage decrease in infant mortality rates was 54.1 percent. At the Maine Yankee reactor in Maine, the percentage decrease was 33.4 percent.

Mangano says people may have been affected by radioactivity that has made its way into the local air, water, milk, vegetation and fish.

While the study does not directly link the cause of the decreased infant mortality rates to less environmental exposure to radiation from power plants, some medical experts say the study confirms a pattern that links radiation and illness.

Other environmental factors, such as pesticide use, heavy industry, incinerators and waste dumps did not significantly change in the regions studied during that short two year time period, says Janette Sherman, a medical doctor who specializes in internal medicine and toxicology. Sherman, who has written several books about the relationship between chemical exposure and disease, says the study confirms the best of public health principles: that when you remove a known cause of illness, health improves.

"What is gratifying about the research is that it showed childhood health measures increasing so dramatically and quickly after the reactors closed," she says.

Environmental advocacy groups say the study raises public policy questions about the risks to the health of 42 million people in the United States living downwind and under 50 miles of nuclear power plants.

The Radiation and Public Health Project with the Standing for Truth About Radiation (STAR) Foundation, also based in New York, is urging the NRC to consider Mangano and other health studies when considering license renewal applications. Current NRC rules do not consider local health impacts. Owners of 28 of the 103 reactors at 17 nuclear plants are scheduled to seek license renewals by 2003. Many of these plants have questionable safety records, with documents showing numerous safety violations, says the STAR Foundation.

"Although many believe that emissions and leaks from nuclear power plants are harming those who live near these facilities, the federal government does not consider potential health effects when renewing licenses, says Christie Brinkley, a model who is on the board of the Foundation and is using her celebrity status to help focus public attention on this issue.

The study has already caught the attention of one lawmaker. "At the very least, the government has a responsibility to determine whether emissions from these plants are harming people," said Michael Forbes, a Democratic congressman, at a press conference here Wednesday.

His district in the eastern Long Island region of the state of New York lies across the Long Island Sound from Millstone Nuclear Power Station in the state of Connecticut.

For some residents living near the reactors who feel they have suffered from low-level radiation leaks from nearby reactors, the government's inaction has been "maddening."

Randy Snell, a New York resident who lives near the Brookhaven National Laboratory, learned several years ago that his seven-year-old daughter had developed a rare soft tissue cancer called rhabdomyosarcoma.

Snell has discovered 19 other cases of the same rare cancer in the county where he lives. In one area near the laboratory, the rate of cancer in children under 10 since 1994 is 15 times the national average, he says. "State and federal public health agencies haven't lifted a finger to confirm the link between Brookhaven and all these rare child cancers," he says. "I hope this study forces them to act."

*** Low Dose Radiation Risk -- Exposure found deadlier, more widespread than ever**

*** Large increases found in deadliness, background, dumping estimates, dispersal speed and exposures**

1 A group of British scientific experts says plutonium is 10-to-1000 times more dangerous than officially estimated, a finding that should provoke a re-write of guidelines for "allowable" exposures and stricter rules regarding its management and containment.

Members of the UK government's Committee Examining Radiation Risks from Internal Emitters (CERRIE) were unanimous in saying that exposure to low levels of plutonium may cause more damage to human cells than previously believed. However, the group was acrimoniously split over how deadly internal plutonium exposures actually may be.

("Plutonium cancer risk may be higher than thought," *New Scientist*, July 18, 2004; See "2003 Recommendations of the European Committee on Radiation Risk: Health Effects of Ionizing Radiation Exposure at Low Doses for Radiation Protections Purposes," Chris Busby Editor, Green Audit Press, Castle Cottage, UK)

2 The U.S. Atomic Energy Agency (the Energy Department's Predecessor), spewed 100 times more plutonium into unlined pits and dumps than previously acknowledged, according to the DOE.

3 The United States has admitted that workers at nuclear weapons factories contracted cancers from radiation exposures the government said were harmless. The embarrassing admission opens the door for compensation for some survivors and victims.

1999: Government admits "safe" doses caused cancers among nuclear weapons workers (*New York Times*, July 15, 1999, p. A1)

2000: U.S. admits "safe" doses killed weapons workers; ends decades of denials

The admission was part of the government's most comprehensive review ever of studies of worker health. Almost 600,000 people who have worked in the nuclear weapons complex since 1945, the report said, and it names 22 categories of cancer presumed to be caused by low-doses of radiation, "most of them fatal" -- including bone, bladder, prostate, kidney, salivary gland, lung, as well as leukemias and lymphomas. (*New York Times*, Jan. 29, 2000)

4 The latest edition of "Biological Effects of Ionizing Radiation (BEIR-VII) says there is no safe exposure level; that is, there is no "threshold" below which exposure to radiation is safe. The June 2005 report rebuts the pop culture "hormesus" theory -- that a little radiation is good and acts like a vaccination -- promoted by industry boosters in business and academia.

5 A group of researchers at the Univ. of Leicester in England found that radiation from Soviet bomb test fallout caused gene mutations in families living nearby. Published in the journal *Science*, the study indicates that low-level radiation from bomb test fallout causes genetic mutations that can be passed to future generations.

"For the generation exposed to radiation from bomb tests in 1949, 1951, 1953 and 1956, the study found a mutation rate about 80 percent higher than in the corresponding generation in the control group," the researchers found.

Yuri Dubrova, who led the work, earlier found similar mutations among people exposed to fallout from the 1986 Chernobyl disaster in Ukraine. ("Mutations in human DNA linked to atomic tests in Kazakhstan," AP, *Minneapolis StarTribune*, Feb. 8, 2002)

6 In 1992, two separate research teams -- one at Harvard the other at Oxford -- discovered a previously unknown "delayed mutation effect" in mice caused by low-level alpha and X radiation. The scientists found chromosome damage in descendant cells, many cell divisions after exposure.

The significance of the findings is that the irradiated cell's immediate descendants appeared normal, but passed on damage that only appeared much later. If confirmed, these studies foretell an eventual "ballooning" of leukemia and other cancers long after one's exposure to radiation. (*New York Times*, February, 20, 1992, p. A12.)

7 As many as 15,000 people living in the U.S. were killed by cancers caused by exposures to 18 radioactive isotopes that were among hundreds of nuclear poisons spewed by above-ground nuclear bomb tests, the government says. The study, by the National Cancer Institute and the Centers for Disease Control and Prevention reported in August 2001, also found a total of about 80,000 non-fatal cancers may have been caused by the radioactive from the fallout.

("Cancer linked to cold war bomb tests," *The Guardian Weekly*, March 21-27, 2002; "Fallout likely caused 15,000 deaths," *USA Today*, March 1, 2002)

The limited analysis excludes the cancers caused by 250 other isotopes, and the radiation spread by Chinese atmospheric tests from 1964 to 1980; French tests between 1963 and 1974, pre-1951 tests in the Marshall Islands and the USSR, and the original three U.S. radiation experiments in Alamogordo, New Mexico, Hiroshima and Nagasaki.

("Fallout, Cancer and Politics," *The Nation*, March 26, 2002)

"Any person living in the contiguous United States since 1951 has been exposed to radioactive fallout," the study found, "and all organs and tissues of the body have received some radiation exposure."

The report was ordered after a 1997 NCI study found that a single radionuclide, Iodine-131, was linked to up to 212,000 cases of thyroid cancer.

8 Dr. Laura Shields, a former AEC scientist, has studied medical records of 13,210 Navajo babies born in Shiprock, New Mexico between 1964 and 1981. Her results show two divergent trends in birth defects before and after 1975: an epidemic before 1975 with rates between 2 and 15 times the rates of normal Indian populations, and a sudden decline to normal rates after 1975. In 1974, a project was started to cover a 40-acre radioactive tailings pile that had been exposed for years.

(Christopher Norwood, "Terata: Only 88 Out of 100 American Babies Are Born Without Defects. If the Birth Defect Crisis Continues, 'Terata' Will Become a Household Word," *Mother Jones*, January 1985, p.21)

9 New calculations done by the National Council on Radiation Protection and Measurements estimate that the average person in the U.S. is exposed to 360 millirem of external radiation in a year, more than double the previous estimate of 170 mR/year. The amount is about equal to the radiation of more than 25 chest X-rays, "which remains far below the limits set by Federal safety standards," the NYT reported.

The report, "Ionizing Radiation Exposure of the Population of the U.S.," report No. 93, costs \$15 from NCRPM, 7910 Woodmont Ave., #1016, Bethesda, MD 2081. (Warren Leary, "Radiation Estimate in U.S. Almost Doubled in Report," *New York Times*, Nov. 20, 1987.)

10 A 2-year government study has found a marked increase in leukemia deaths among people living near Northern State Power Co.'s Prairie Island nuclear power reactor in SE Minnesota. The "significantly high" incidence of leukemia deaths appeared among Prairie Island area residents between the ages of 40 and 59, a National Cancer Institute report said.

The leukemia risk rate for people aged 40 to 59 in Goodhue County, Minn. and Pierce County, Wis., near the reactor, was 141-percent higher than in other counties. Before the reactor opened in 1973, the risk was 17 percent lower.

Tom Bushee, speaking for NSP, said the study shows "that our operating power plants have releases that are so low that one would not expect to see any health effects at all." He said the increased leukemia death rate was unrelated to the NSP reactor, and that the company would look for an explanation.

(Philip Brasher, AP, "Study finds no link between nuclear plants, cancer deaths: But leukemia deaths near Prairie Island plant high in older age group," *St. Paul Pioneer Press*, Sept. 20, 1990)

11 Infant mortality rates around five U.S. nuclear power reactors dropped almost immediately after the reactors were closed, according to studies by the New York-based Radiation and Public Health Project, and published in the Spring 2000 edition of *Environmental Epidemiology and Toxicology*.

The study by Joseph Mangano, a nationally known epidemiologist, found that from 1985 to 1996, average infant death rates dropped 6.4 percent every two years.

But in areas surrounding five reactors shut down between 1987 and 1995 (Genoa, near LaCrosse, Wisc., closed in 1987; Rancho Seco, outside Sacramento and Ft. St. Vrain in Colo., both closed in 1989; Trojan, by Portland Oregon, shut in 1992; Millstone in Conn., closed in 1995), infant death rates dropped an average of 18 percent in the first two years.

Additional research at Maine Yankee and Big Rock Point in Michigan, both shuttered in 1997, showed that infant death rates fell a 33.4 percent and 54.1 percent, respectively.

(Harvey Wasserman, "No Nukes Equals Better Health," *The Nation*, Jan. 29, 2001, p7; and Danielle Knight, "Infant mortality rates drop around five reactors after reactors closed," *Mother Jones*, May 4, 2000)

12 Michigan, both "From the beginning of the nuclear era until 1989, radiation doses from radioactive materials inhaled or ingested by workers were not calculated or included in worker dose records.

"Large numbers of workers have received information about their radiation exposures which systematically understates their actual exposures.

"Limits for allowable exposures have varied over the years, but have generally tended to decline as evolving knowledge about the cancer risks from radiation indicated that the dangers it posed were greater than previously thought.

"For instance, the limit for lung exposure until 1958 was 15 rem per year for workers and off-site populations. It was lowered for off-site populations to 1.5 rem per year in 1959."

(Arjun Makhijani and Bernd Franke, "Worker Radiation Dose Records Deeply Flawed," *Science for Democratic Action*, Nov. 1997)

1987: Estimated amount of radiation to which an average American is exposed — doubled.

Eighteen months after Chernobyl, the federal government officially doubles its estimate of the amount of radiation to which the average North American is exposed in a year, from 170 millirem to 360 mR. Nuclear industry workers are allowed to absorb 5000 mR in a year. (*New York Times*, Nov. 20, 1987, p.A1)

1989: Risk of cancer from low levels — quadrupled.

"Will probably force regulatory bodies to reduce the maximum exposure allowed for workers in the nuclear industry and hospitals" ... "the maximum amount that nuclear plants may give off may also be affected"

The new estimate indicates "a much greater danger" of mental retardation among babies exposed in the womb. And the standard will increase the number of people expected to get cancer from radiation accidents like the 1979 Three Mile Island and 1986 Chernobyl disasters.

(The National Research Council's BEIR-V — the "Bible" used by the gov't to set standards for allowable radiation exposure around the world — declares that the risk is 3-1/2 to five times as high as those in the previous BEIR. The council is the research arm of the National Research Council. (*New York Times*, Dec. 20, 1989, p.A1)

1990: Workers' exposures 2.5 times too high

ICRP wants worker exposure limits cut from 5000 mR to 2000 mR per year. **"The recommendation is likely to result in new regulations..."**

"Since the 1977 recommendations were drafted, scientists have tripled their estimate of the damage inflicted by a given dose of radiation." The NRC was only then in the final stages of adopting the 13-year-old recommendations. (*New York Times*, June 23, 1990, p.A1)

March 1991: Low doses cause up to 10-times as much cancer as previously thought.

The findings, "if confirmed could call into question existing standards intended to protect workers"

("Radiation risks may be more than believed," by Janny Scott, *Los Angeles Times*, Mar. 20, 1991; re, Dr. Steve Wing, *Journal of the American Medical Association*, Mar. 20, 1991)

Feb. 1992: A long-delayed radiation injury called "delayed mutation effect" was discovered independently by two groups of scientists. The findings "may eventually lead to more stringent

standards"; and "if the work is confirmed, estimates of the health risks of radiation may have to be revised upward."

Eric Wright at the British Medical Research Council Radiobiology Unit, Oxford, and John Little at the Harvard Univ. School of Public Health, both found that some cells that survive radioactive assault appear normal, but produce abnormalities several cell divisions later. "This could have implications for the eventual rise of leukemias and other cancers long after exposure to radiation," Dr Wright said. (*New York Times*, Feb. 20, p.A12; & *Nature*, Feb. 20, 1992)

Dec. 9, 1992: People exposed to small "allowable" doses of radiation are four to eight times more likely to develop cancer than previous estimates suggested. Dr. Alice Stewart, whose 1976 government study found higher cancer rates among U.S. nuclear weapons workers, had her findings rejected and funds cut off. Stewart reviewed the earlier statistics in 1990 leading to the new conclusions. (*New York Times*, Dec. 8, 1992; Alice Stewart & Geo. Kneale, *American Journal of Industrial Medicine*, March 1992)

MISSTATEMENTS OF FACT

New York Times, Dec. 2, 1989, p.A1: "But even the new estimate that radiation is a more potent carcinogen than previously believed should cause no concern for the average person, experts said, because the public is not exposed to enough radiation to exceed levels considered safe."

On the Contrary: All Government Agencies Agree Every Radiation Exposure Raises Cancer Risk

When a radiation accident happens, major news organizations are quick to sugar-coat the potential health and environmental consequences.

Most often, the second or third sentence in nuclear accident stories includes the phrase, "no danger to the public" or a more sophisticated lullaby, in spite of the fact that government agencies that regulate radiation exposure all warn that every dose of radiation is dangerous no matter how small.

The Dec. 2, 1989 *New York Times* said this about the cancer risk from exposure: "But even the new estimate that radiation is a more potent carcinogen than previously believed should cause no concern for the average person, experts said, because the public is not exposed to enough radiation to exceed levels considered safe."

Evidently, the *Times* didn't talk with or consult public or private expert opinion. Every federal agencies that regulates radiation exposures agrees that there is no safe level of exposure, that every bit of ionizing radiation to which we are exposed carries with it a risk of causing cancer.

Below are official U.S. government assessments. They all conclude: Every dose is a danger to the public.

U.S. Environmental Protection Agency, EPA

"Based on current scientific evidence, any exposure to radiation can be harmful (or can increase the risk of cancer). In other words, it is assumed that no radiation exposure is completely risk free.(1)

"[T]here is no level below which we can say an exposure poses no risk. ... Radiation is a carcinogen. It may also cause other adverse health effects, including genetic defects in the children of exposed parents or mental retardation in the children of mothers exposed during pregnancy.(2)

"...In other words, it is assumed that no radiation exposure is completely risk free.(3)

"Current evidence suggests that any exposure to radiation poses some risk, i.e. there is no level below which we can say an exposure poses no risk."(4)

U.S. Department of Energy, DOE

"[T]he effects of low levels of radiation are more difficult to determine because the major effect is a very slight increase in cancer risk. ... U.S. Government regulations assume that the effects of all radiation exposures are cumulative and should be limited as much as reasonably possible."(5)

U.S. Nuclear Regulatory Commission, NRC

"[T]he radiation protection community conservatively assumes that any amount of radiation may pose some risk for causing cancer and hereditary effect, and that the risk is higher for higher radiation exposures. A linear no-threshold dose-response relationship is used to describe the relationship between radiation dose and the occurrence of cancer. ... any increase in dose, no matter how small, results in an incremental increase in risk."(6)

U.S. Department of Health and Human Services, HHS

"Ionizing radiation is invisible, high-frequency radiation that can damage the DNA or genes inside the body.

"Some patients who receive radiation to treat cancer or other conditions may be at increased cancer risk. ... it is possible that there is a small risk associated with this exposure.

"... children whose mothers received diagnostic X-rays during pregnancy. ... were found to have increased risks of childhood leukemia and other types of cancer, which led to the current ban on diagnostic X-rays in pregnant women."(7)

National Academy of Sciences (BEIR VII)

The National Academy of Sciences' June 2005 issued BEIR VII, in June 2005, the latest in its series of book-length reports. NAS member and professor emeritus of radiology at Stanford and Harvard Herbert L. Abrams said, "There appears to be no threshold below which exposure can be viewed as harmless."(8)

U.S. National Council on Radiation Protection, NCRP

"... every increment of radiation exposure produces an incremental increase in the risk of cancer."(9)

Notes:

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- 2) EPA, "Radiation: Risks & Realities," *Air & Radiation* 6602J; EPA 402-K-92-004, Aug. 1993, p.3
- 3) EPA, "Ionizing Radiation Series," No. 2, May 1998, *Air & Radiation*, 6601J, EPA 402-F98-010.20
- 4) "Radiation: Risks and Realities," EPA, August 1993, *Air & Radiation* 6602J, EPA 402-K-92-004, p.3
- 5) "Understanding Radiation," DOE/NE, 0074, p. 8 & 9,
<<http://www.ne.doe.gov/pdfFiles/UNDERRAD.PDF>>
- 6) NRC, "How Does Radiation Affect the Public?" <http://www.nrc.gov/what-we-do/radiation/affect.html>
- 7) "Cancer and the Environment: Ionizing radiation," p. 10. <www.cancer.gov/images/Documents/5d17e03e-b39f-4b40-a214-e9e9099c4220/Cancer%20and%20the%20Environment.pdf>
- 8) Sharan L. Daniel, Stanford University, *Stanford Report*, Oct. 25, 2005
- 9) Institute for Energy & Environmental Research, *Science for Democratic Action*, June 2005, citing National Council on Radiation Protection, "Evaluation of the Linear-Non-threshold Dose-Response Model for Ionizing Radiation," NCRP report 136, Bethesda, Maryland, June 4, 2001

Link between A-plant radiation and cancer rates fair inquiry |

Asbury Park Press Online, Sunday, July 15, 2007; (Asbury Park Press; 3601 Highway 66, PO Box 1550, Neptune, NJ 07754; (732) 922-6000); By Paula Gotsch

Under the guise of "cool-headed science," Dr. Letty Goodman Lutzker's heated arguments against what she calls "anti-nuclear ideologues" seem more like a highly emotional, Dr. Strangelove-type diatribe in favor of "all that is nuclear" than a respectful, reasoned contribution in response to legitimate questions by concerned parents. ("Scientific evidence doesn't support 'Tooth Fairy Project' claims," *Commentary*, July 10.)

What environmental factors or combination of environmental factors could be contributing to the rise in childhood cancer rates in Ocean County?

Hysterical rants on either side do little to foster serious study. Lutzker's "case closed" fiat in favor of a highly dangerous technology seems markedly unscientific in light of the 2005 Beir VII Report from the National Research Council of the National Academy of Sciences. It found no amount of radioactivity, however small, can be deemed safe.

The report, "The Biological Effects of Ionizing Radiation VII," reviewed available human and animal cancer data and scientific understanding arrived at by using cellular-level studies. The Beir series of reports is considered the most authoritative basis for radiation risk estimation in the U.S.

The Nuclear Regulatory Commission's founding mission is stated as the protection of the public from the adverse effects of radiation. The NRC was founded because of the highly dangerous nature of the nuclear industry. Nuclear energy is not and has never been a safe over-the-counter technology. Any blanket dismissal of the need to monitor this self-admitted dangerous technology is grossly unscientific.

Therefore, one would expect that the NRC would be conducting ongoing scientific investigative studies regarding the effects of routine radiological emissions from the operation of nuclear power plants on the unborn and on infants, those most subject to biological disruption from the effects of radiation. One would think so. But there are no studies being done by the NRC on the effects of operational discharge of radionuclides by nuclear plants on infants and embryos. A telephone call to the NRC is all it takes to learn this.

The NRC uses the effects on the adult male as the yardstick for safe dosage exposure. This in spite of the fact Beir VII found cancer risk doubles for women (as compared to men) and that the differential risk for children is even greater — three to four times the risk in the first year of life for boys — as exposure for adult males ages 20-50. Female infants have almost double the risk of male infants.

Contrary to Lutzker's claim, a parade of older, outdated studies is not the gold standard for the effects of "routine" low-level radiation. Her brusque dismissal that they are is outdated as well. And as nuclear plants are aging, leakage of radioactive substances increases beyond the "routine," as is documented by the industry.

Let us not impoverish ourselves by shutting down scientific inquiry on an open question. Lutzker's highly emotional defensive reaction seems inappropriately unscientific and more indicative of a closed mind.

The wealthy and politically backed nuclear industry owes the parents and children of this country, including the unborn, serious scientific studies regarding the origin and effects of strontium 90 and other nuclides found in our children's bodies. The industry is not doing these studies. It prefers to spend its time trying to close off the question and recruiting apologists to legitimize its negligence.

Paula Gotsch, Brick, is a member of Grandmothers, Mothers and More for Energy Safety. GMMES

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Is nuke truth in the tooth?

Gloucester County Times, New Jersey, Wed., June 13, 2007 (Woodbury, NJ)

<http://www.nj.com/news/gloucester/index.ssf?/base/news-2/1181716088322010.xml&coll=8&thispage=1>

By Trish G. Graber, tgraber@sjnewsco.com

TRENTON A researcher who has collected baby teeth from residents living near the Oyster Creek nuclear power plant said test results that show a correlation between radioactive emissions and cancer should be considered before re-licensing the oldest nuclear power plant in the country.

"We want this information placed in the policy arena," said Joseph J. Mangano, national coordinator for the Radiation and Public Health Project.

Mangano has collected 5,000 baby teeth, 500 in New Jersey, and tested them for Strontium-90 a radioactive chemical produced only by nuclear reactors and nuclear bombs.

His research on the "Tooth Fairy Project" rejected by industry representatives shows that when Strontium-90 levels began to decrease in teeth tested from children born in Ocean and Monmouth counties in the mid-1980s, cancer rates in children dropped as well. Test levels showed a rise in Strontium-90 in the early 1990s with a correlating jump in the cancer rate in children.

Backed by a group of medical and academic professionals, Mangano launched a public education campaign Tuesday by releasing a compilation of his findings in the executive summary of a report due out this summer.

"It is essential that data on radioactive contamination and the potential link with cancer be scrutinized before any decision on license extension is made," Donald Louria, professor of preventive medicine at the New Jersey Medical School, said at the Statehouse Tuesday.

The campaign comes as the Nuclear Regulatory Commission is considering a 20-year license extension for the Oyster Creek plant in Ocean County one of four reactors in the state which is due to expire in April 2009.

That relicensing may be important for the future of the state's other nuclear power plants: PSEG's Hope Creek reactor in Salem County, whose license expires in 2009; and Salem I and Salem 2, which expire in 2016 and 2020, respectively.

Norm Cohen, a spokesman for UNPLUG Salem, which opposes the Salem plant's operation, called Oyster Creek "a key battleground."

"If the (Nuclear Regulatory Commission) is willing to re-license Oyster Creek, then what chance do we have at stopping Salem?" he said.

Industry officials refute the results of the baby-teeth study, and the Nuclear Regulatory Commission contends that "numerous peer-reviewed scientific studies do not substantiate such claims" that nuclear power plant emissions contribute to cancer.

Diane Screnci, Philadelphia region spokeswoman for the Nuclear Regulatory Commission, said Tuesday that officials have looked at the Radiation and Public Health Project's studies and found the group has not followed general research principles: They used very small samples to draw general conclusions and did not examine the impacts of other risk factors, among others.

"Ninety-nine percent of Strontium-90 comes from the fallout from weapons testing," Screnci said.

Referencing Mangano's study, Cohen explained that when nuclear testing was halted in 1963, Strontium-90 presence declined. The 1986 Chernobyl nuclear accident in the Ukraine explained some of the later rise in Strontium but not the continued elevation into the mid-1990s. "When the nuclear plants came online the question was where was the Strontium coming from," Cohen said. "There's a red light in saying something is happening."

In Salem, Cohen said he does not claim that PSEG's plants cause cancer; however, he believes they contribute to the problem. About 20 teeth were collected for studies in Salem in 2000, he said not enough to draw any solid conclusions.

PSEG officials in Salem could not be reached late Tuesday for comment. Oyster Creek company officials said they are familiar with the studies and, like the NRC, dismissed the findings.

"There is no new information presented in (Mangano's) studies, just more of the same that has been debunked by regional and national health organizations such as the National Institutes of Health," said Leslie Cifelli, a spokeswoman for the plant. "Oyster Creek has ongoing, robust environmental monitoring programs and we have no evidence of any effects of Strontium-90 on the community."

Mangano's findings rely on official data from Oyster Creek, which is required to be monitored.

Industry officials say that nuclear plants emit low-level radioactivity that is a fraction of the level of exposure during a routine dental X-ray. Individual plants monitor Strontium-90 emissions into the air and environment, which they are required to report to the NRC.

Screnci said regulators ensure that plants understand the monitoring process and the method of compiling the data. However, the commission does not conduct independent sample testing.

Mangano noted that the industry conducts no testing of radioactive levels in the body.

He is continuing his work this year with \$90,000 from the Educational Foundation of America and the Louis and Harold Price Foundation.

In 2003, he received a \$25,000 grant from the state of New Jersey to conduct baby-teeth testing, a few years after actor Alec Baldwin came on board to promote the Tooth Fairy Project in Toms River.

Mangano is hoping to raise public awareness on the issue in the coming months with the new report on the risks of keeping Oyster Creek in operation, due out this summer.

"We are calling on not just citizens to become more involved ... but public officials as well," he said. "They represent citizens, it is their job to protect them and to make sure that the regulators are doing their job."

More information on Mangano's work can be found at www.radiation.org. © 2007 Gloucester County Times

U.S. Could Cut 28% of Greenhouse Gases & Save Money Doing It

As reported in *The New York Times*, Nov. 30, 2007 (p.C5), the United States could eliminate up to 28 percent of the greenhouse gases it spews without spending much and by using existing techniques and tax incentives, according to a new study.

Energy experts at the consulting firm McKinsey & Company report that this huge pollution reduction would pay for itself — both in industry and individual households — in lower utility bills.

According to Jack Stephenson, a director of the study, the United States is brimming with "negative cost opportunities," or in other words potential improvements in lighting, heating and cooling of buildings that cut carbon dioxide emissions from the burning of fossil fuels — even while they save money.

Stephenson pointed out that, "These types of savings have been around for 20 years."

"What the report calls out is the fact that the potential is so substantial for energy efficiency," said Ken Ostrowski, another of the report's authors. "...the potential is just staggering here in the U.S. There is a lot of inertia, and a lot of barriers."

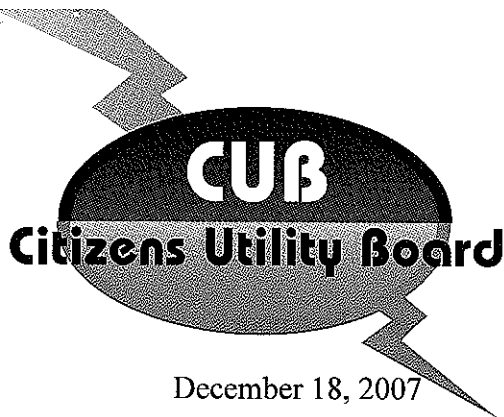
Efficiency changes can be made, the report found with "tested approaches and high-potential emerging technologies," but the work "will require strong, coordinated, economy-wide action that begins in the near future."

One significant change recommended by the authors is that regulations for large utilities could be rewritten so the companies make as much profit by promoting conservation as in selling electricity.

Tax breaks could promote efficient buildings, cars and appliances and "a broad public education program around wasteful energy consumption could be mounted," the report noted. Like the "Keep

America Beautiful" campaign of the 1960s; it could teach about "carbon littering" by increasing awareness of wasting energy.

*McKinsey & Company is a large firm with over 4,000 consultants and as many supporting staff and offices in 38 countries. Its energy study was done for DTE Energy (owner of **Detroit Edison**), Environmental Defense, **Honeywell**, National Grid, the Natural Resources Defense Council, **Pacific Gas & Electric** and **Shell**.*



December 18, 2007

To: The Honorable Phil Montgomery, Chair, Assembly Committee on Energy and Utilities

The Honorable Members of the Assembly Committee on Energy and Utilities

From: Charlie Higley, Executive Director, Citizens Utility Board

Subject: **Please oppose three bills related to nuclear power: AB 346, AB 347, and AB 348.**

The Citizens Utility Board (CUB) respectfully requests that you oppose three bills related to nuclear power, AB 346, AB 347, and AB 348.

Founded in 1980, the Citizens Utility Board of Wisconsin is a member-supported, nonprofit organization that advocates for reliable and affordable utility service. CUB represents the interests of residential, farm, and small business customers of electric, natural gas, and telecommunication utilities before regulatory agencies and the courts.

AB 346, repealing the limits on the construction of nuclear power plants

CUB opposes this legislation, which would repeal Wis. Stat. §196.493, the so-called “nuclear moratorium law.” We believe this law includes common-sense provisions that protect ratepayers and the environment from the costs and environmental dangers of nuclear power, and that it should not be repealed.

The nuclear moratorium law doesn’t ban the construction of nuclear plants. It simply requires that several criteria be met before the Public Service Commission of Wisconsin (PSC) can authorize the construction of a nuclear plant. Two of the most important criteria are that:

- a waste repository is available for radioactive waste created by Wisconsin reactors, and;
- a nuclear plant is economically advantageous to ratepayers in comparison to alternatives.

Unless nuclear power can pass these simple requirements, nuclear power plants should not be built in Wisconsin.

There are many other reasons why nuclear power has been and continues to be a poor choice for meeting Wisconsin's electricity needs. Wisconsin's best approaches are to aggressively save energy and to develop its renewable energy resources. Energy efficiency and renewable energy can help reduce the flow of energy dollars out of Wisconsin's economy, whereas nuclear cannot, since Wisconsin has no uranium reserves. Regarding employment, far more jobs can be created in Wisconsin's energy efficiency and renewable energy sectors than can be created by constructing and operating nuclear power plants.¹

Energy efficiency and renewable energy are the cornerstones of the "Energy Security and Climate Stewardship Platform" and the "Midwest Greenhouse Gas Accord," recently signed by ten Midwestern governors through the leadership of Governor Jim Doyle.² These agreements will make the Midwest the leader in the development of energy efficiency technologies and renewable energy resources that are already creating new jobs in Wisconsin and other Midwestern states.³ Nuclear power is not even mentioned in these agreements.

Nuclear power remains one of the most expensive ways to generate electricity. Several recent studies have concluded that a new nuclear plant would cost between \$3,600 and \$4,000 per kilowatt of capacity (in 2007 dollars).⁴ Wind farms are being built in Wisconsin today at a cost of \$2,000 per kilowatt of capacity.⁵ The cost information for wind is real, whereas no new nuclear plants have been built in the U.S. for many years. No one is really sure how much it will cost to build a reactor in the U.S., which is why the federal government is offering loan guarantees and other subsidies for new nuclear plants.

CUB is hopeful that, with aggressive energy efficiency and renewable energy efforts, Wisconsin utilities will not need to build new baseload power plants to replace Pt. Beach and Kewaunee nuclear plants when their operating licenses expire in 2030 and 2033.⁶ If

¹ Union of Concerned Scientists, *Increasing Wisconsin's Renewable Portfolio Standard Will Create Jobs and Help Stabilize Energy Bills*, fact sheet, 2006.

² For information regarding the Platform and the Accord, visit <http://www.midwesterngovernors.org/energysummit.htm>.

³ Tower Tech Systems, Inc, which builds towers for wind machines, recently opened a factory in Manitowoc.

⁴ Keystone Center, *Nuclear Power Joint Fact Finding*, June 2007, at 42.

⁵ "We Energies purchases wind turbine equipment from Vestas," press release issued March 29, 2007.

⁶ The operating license for Kewaunee will expire in 2013, unless Dominion Energy is granted a 20-year license renewal from the U.S. Nuclear Regulatory Commission, which it intends to apply for in September 2008 (<http://www.nrc.gov/reactors/operating/licensing/renewal/applications.html>).

baseload power plants are needed, we would likely support any technology other than nuclear for one reason alone: Other technologies do not generate nuclear waste.

Nuclear waste is one of the biggest problems created by the nuclear power industry for which no country has developed a solution. Not only is nuclear waste deadly for hundreds of thousands of years, it can be used to make nuclear weapons, and it represents a target for terrorists. By itself, nuclear waste makes nuclear power a poor choice for generating electricity.

Regarding nuclear waste in Wisconsin, the U.S. Department of Energy was required by law to begin the removal of radioactive waste from Wisconsin's nuclear reactors beginning in 1998.⁷ To pay for the waste removal, Wisconsin ratepayers have paid a total of \$594 million to the federal government as of March 31, 2006.⁸ Yet the federal government has failed to build a permanent disposal site for the waste at Yucca Mountain, Nevada. Therefore, the waste hasn't been removed and is being stored on the shores of the Mississippi River and Lake Michigan. If the nuclear moratorium law is repealed and nuclear plants are built in Wisconsin, even more radioactive waste will be stored in Wisconsin, likely near these or other important water resources, and may never be removed by the federal government.

We also oppose repealing §196.493 because if the federal government doesn't license Yucca Mountain, or if radioactive waste continues to be generated at its current pace, a second nuclear repository will be needed, and Wisconsin would be a prime candidate.⁹ In fact, in 1986 the U.S. Department of Energy recommended Wisconsin's Wolf River area as a permanent disposal site for nuclear waste. If the nuclear moratorium law is repealed and additional nuclear plants are built in Wisconsin, the federal government will likely look again to the Wolf River area as a permanent disposal site for radioactive waste.

AB 347, requiring the Public Service Commission to investigate future electric supplies...

Although we would like the PSC to strengthen its energy planning process, we oppose this legislation because it would unnecessarily restrict the analyses the PSC could use to plan for Wisconsin's future energy needs. We believe that the Special Committee on Nuclear Power, which drafted this legislation (and on which CUB served), did not have the time or the resources to develop a bill that would provide the PSC with the appropriate authority and framework for long-range energy planning. In short, this legislation would not lead to the development of useful energy plans.

⁷ Congressional Research Service Report for Congress, September, 2006, Civilian Nuclear Waste Disposal.

⁸ Eric Callisto, Executive Assistant to the Chairperson, Public Service Commission of Wisconsin, in a presentation to the Legislative Council Special Committee on Nuclear Power, September, 2006.

⁹ Joseph Strohl, Chairperson, Radioactive Waste Review Board, High-Level Nuclear Waste: A Wisconsin Perspective.

December 18, 2007

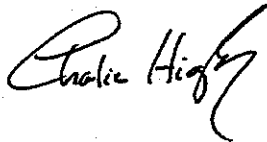
Page 4 of 4

AB 348, requiring the Public Service Commission to advocate on matters related ... to radioactive waste

We oppose this legislation because it would force the PSC to support various proposals for dealing with nuclear waste even if they would harm the public interest. We believe the intent of this provision is to continue to put pressure on Nevada to become a dump for the nation's nuclear waste, even though the site at Yucca Mountain appears not to be appropriate. This legislation could come back to haunt Wisconsin if the Wolf River area is ever proposed as a repository.

For these reasons, we urge you to oppose AB 346, AB 347, and AB 348.

Sincerely,

A handwritten signature in cursive script, appearing to read "Charlie Higley".

Charlie Higley
Executive Director

✓
PSR[®]

Physicians for
Social
Responsibility

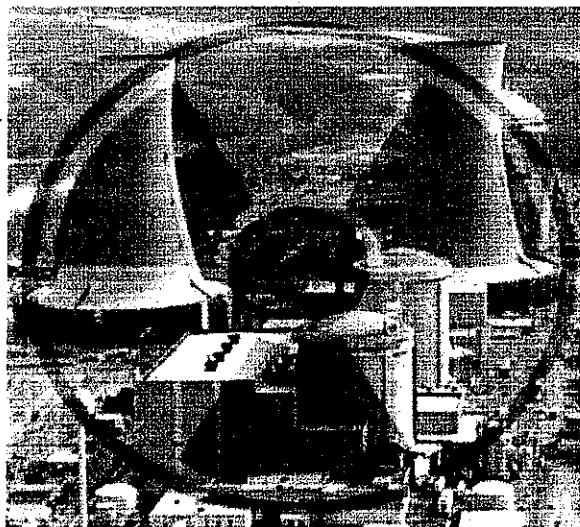
Dirty, Dangerous and Expensive: The Truth About Nuclear Power

In recent years, the administration has sought to revitalize the nuclear power industry by exploiting growing concerns about global warming and energy insecurity to promote nuclear power as a clean, safe and affordable way to curb our emissions of greenhouse gases and reduce our dependence on foreign energy resources. Yet despite the claims of the administration and industry proponents, a thorough examination of the full life-cycle of nuclear power generation reveals nuclear power to be a dirty, dangerous and expensive form of energy that poses a number of serious risks to human health and national security. From the 2,000 metric tons of high-level radioactive waste¹ and 12 million cubic feet of low-level radioactive waste² produced annually in the U.S., to the serious risk of nuclear accidents and nuclear terrorism, to the billions of dollars in handouts received in the form of subsidies, tax breaks and limited insurance liability, nuclear power is not the solution to our concerns over climate change and energy supplies.

Neither Clean Nor Emissions-Free

Nuclear power is touted by its advocates as a clean, emissions-free source of energy that can help to mitigate global warming. Yet each year, enormous quantities of radioactive waste are created during the nuclear fuel process. In fact, the production of 1,000 tons of uranium fuel (less than two percent of annual global consumption) generates approximately 100,000 tons of radioactive tailings and nearly one million gallons of liquid waste carrying heavy met-

als and arsenic in addition to its radioactivity.³ Further, more than 54,000 metric tons of highly radioactive spent fuel has already accumulated at reactor sites around the U.S. for which there currently is no permanent repository.¹ Even without any new nuclear production, the inventory of commercial spent fuel in the U.S. would already exceed the 63,000 metric ton statutory capacity of the controversial Yucca Mountain repository by its earliest possible opening date of 2017.^{4,5}



Although it is true that the actual generation of electricity through the process of nuclear fission does not produce greenhouse gases, and while life cycle estimates^{6,7,8} of greenhouse gas emissions from nuclear power generation vary considerably, to state that nuclear power produces zero emissions is false. From ore mining and enrichment of uranium to processing and storage of nuclear waste, the nuclear fuel

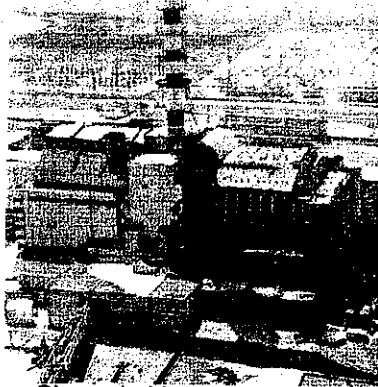
cycle requires tremendous amounts of energy, most of which is derived from fossil fuels that produce significant quantities of global warming gases. Additionally, the materials and processes involved in both the construction and decommissioning of nuclear power plants also contribute to greenhouse gas emissions. Growth of the nuclear industry would actually cause the greenhouse gas intensity of nuclear power production to rise by exhausting the earth's limited supply of rich uranium ores. As plant operators are forced to use poorer quality ores, the energy required to extract and refine the uranium will increase, as will the associated global warming emissions.

Serious Safety Concerns

Despite proponents' claims that it is safe, the history of nuclear energy is marked by a number of disasters and near disasters. The 1986 Chernobyl disaster (Ukraine) is one of the most frightening examples of the potentially catastrophic consequences of a nuclear accident. In the months following the accident, 31 people died from acute radiation sickness and an estimated 220,000

people were displaced from their homes.

While subject to uncertainty given the limitations of epidemiological studies, the long-term effect of exposure to radioactive fallout from Chernobyl is expected to cause between 14,000 and 17,400 fatal cancers in Europe and the former Soviet Union, with the possibility that the death toll could be even higher.⁴



In 1979, the United States had its own disaster following an accident at the Three Mile Island Nuclear Reactor in Pennsylvania. Although there were no immediate deaths, the incident had serious health consequences for the surrounding area. A 1997 study found that those people living downwind of the reactor at the time of the event were two to ten times more likely to contract lung cancer or leukemia than those living upwind of the radioactive fallout.⁹ The dangers of nuclear power have been underscored more recently by the near miss of a catastrophic meltdown at the Davis-Besse reactor in Ohio in 2002, which in the years preceding the incident had received a near-perfect safety score.³

Climate change may further increase the risk of nuclear accidents. Heat waves, which are expected to become more frequent and intense as a result of global warming, forced the shut down of reactors in France, Spain and Germany in July of 2006.¹⁰ And during the European heat wave in the summer of 2003,

cooling problems at reactors in France forced engineers to tell the government that they could no longer guarantee the safety of the country's 58 nuclear power plants.³

Proliferation, Loose Nukes and Terrorism

The inextricable link between nuclear energy and nuclear weapons is arguably the greatest danger of nuclear power. The same process used to manufacture low-enriched uranium for nuclear power production also can be employed for the production of highly enriched uranium for nuclear weapons. As it has in the past, expansion of nuclear power could lead to an increase in the number of both nuclear weapons states and 'threshold' or 'breakout' nuclear states that could quickly produce weapons by utilizing facilities and materials from their 'civil' nuclear programs. This proliferation scenario already has played out once in South Africa in the 1980s and many fear that it may now be playing out again in Iran. Additionally, expanded use of nuclear power would increase the risk that commercial nuclear technology will be used to construct clandestine weapons facilities. This was the proliferation route taken by Pakistan, which remains outside the Nuclear Non-Proliferation Treaty despite its nuclear weapons capability.

More widespread deployment of nuclear power also may facilitate efforts by terrorists to acquire materials for the production of a radioactive 'dirty' bomb and raise the threat of direct attacks on nuclear facilities. According to the Congressional Research Service, nuclear power plants are not designed to withstand attacks using large aircrafts, such as those used on September 11, 2001.¹¹ A well-coordinated attack could have extremely severe consequences for human health and the environment; a study by the Union of Concerned Scientists concluded that a major attack on the Indian Point Reactor in Westchester County, New York could result in 44,000 near-term deaths from acute radiation sickness and more than 500,000 long-term deaths from cancer among individuals within 50 miles of the plant.¹²

Simply Too Expensive

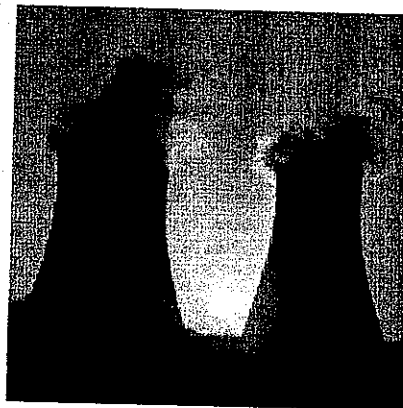
In 1954 then Chairman of the Atomic Energy Commission Lewis Strauss promised that the nuclear industry would one day provide energy "too cheap to meter."⁴ Yet more than 50 years and tens of billions of dollars in federal subsidies later, nuclear power remains prohibitively expensive. Even among the business and financial communities, it is widely accepted that nuclear power would be economically unviable without government support.¹³ Despite this poor economic performance, the federal government has continued to pour money into the nuclear industry – the Energy Policy Act of 2005 alone included more than \$13 billion in subsidies, tax breaks and other incentives for nuclear power. Loan guarantees of nearly \$9 billion are included in the administration's FY08 budget as an incentive for more plants. No other fuel source receives this type of incentive plus the billions of dollars in guaranteed insurance provided by the Price-Anderson Act.

This money would be much better spent on increasing energy conservation, efficiency and developing renewable energy resources. In fact, numerous studies have shown that improving energy efficiency is the most cost-effective and sustainable way to concurrently reduce energy demand and curb greenhouse gas emissions. At favorable sites, wind power already is less expensive than nuclear power on a per kilowatt hour basis. And while photovoltaic power is currently more expensive than nuclear energy, the price of electricity produced by the sun, as with wind and other forms of renewable energy, is falling quickly. Conversely, the cost of nuclear power is rising.^{3,13} It is important to note that there is no waste from wind and solar energy, much less waste that has to be isolated and safeguarded for tens of thousands of years at a cost of billions of dollars.

Making the Safe, Sustainable Investment

It is clear that alternatives to fossil fuels must be developed on a large scale. However, nuclear power is neither renewable nor clean and therefore not a wise option. Even if one were to disregard the waste problems, safety risks and poor economics, nuclear power is both too

slow and too limited a solution to global warming and energy insecurity. Given the urgent need to begin reducing greenhouse gas emissions as quickly as possible, the tremendously long lead times required for the design, permitting and construction of nuclear reactors renders nuclear power an ineffective option for addressing global warming. Further, the effectiveness of nuclear power as a low-carbon energy source is dependent on the availability of rich uranium ore – a finite resource that would be quickly depleted by an expansion of nuclear power.



Were an accident to occur any time during the next ten years, it is likely that any planned nuclear power plants would be scrapped, leaving a significant shortage in the national electric power base load. Establishing policies that would meet projected energy demands with nuclear power is a risky endeavor when those plants may never be built and operated.

When the very serious risk of accidents, proliferation, terrorism and nuclear war are considered, it is clear that investment in nuclear power as a climate change solution is not only misguided, but also highly dangerous. As we look for solutions to the dual threats of global warming and energy insecurity, we should focus our efforts on improving energy conservation and efficiency and expanding the use of safe, clean renewable forms of energy to build a new energy future for our nation.

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Physicians for Social Responsibility has been working to eliminate the threats posed by nuclear weapons since its inception in 1961 and shared in the 1985 Nobel Peace Prize for its work to prevent nuclear proliferation. We view the proposals for new nuclear power plants as an equal proliferation threat. Nuclear power is not a clean option; it is not a renewable option; in short, it is not a viable option for a clean energy future.

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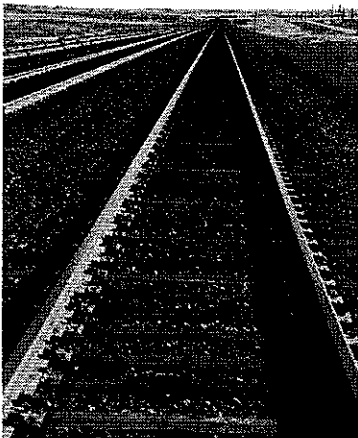
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Bringing Hiroshima Home Concerns for the Transport of Nuclear Waste

Erin Blankenship, *Scoville Peace Fellow*

FACT SHEET

Why is Nuclear Transport an Issue?

The process of approving a high-level nuclear waste repository at Yucca Mountain faces many serious setbacks. Included in the debate is the fact that tens of thousands of tons of highly hazardous nuclear waste is going to have to cross through 45 states, the District of Columbia, and through or near virtually every major American city, putting tens of millions of Americans at risk of exposure to nuclear radiation. (1)

U.S. nuclear power plants have already produced more than 40,000 tons of high-level waste, adding 2,000 tons annually. Presently most of the radioactive waste is stored on site at the power plant where it was generated. But storage capacity is disappearing quickly and industry pressure is mounting to get the waste moved to the proposed federal repository at Yucca Mountain. The nuclear industry and utility companies are pressuring for the issue to be resolved quickly, supporting among other ideas interim storage sites for the spent nuclear fuel. However, there are significant risks to consider. (2)

How Will Transport Work?

If the Yucca Mountain repository becomes operational, DOE and the state of Nevada analysis project approximately 108,500 truck shipments or more than 36,000 combined rail and truck shipments will be required to move the approved 77,000 tons of high-level radioactive waste expected to be buried at the

Yucca Mountain nuclear waste dump. (1)
To put this in perspective, if DOE selects a truck shipment model, a truck shipment of high-level radioactive waste would be required every 4 hours, around-the-clock, 365 days a year, for 38 years.

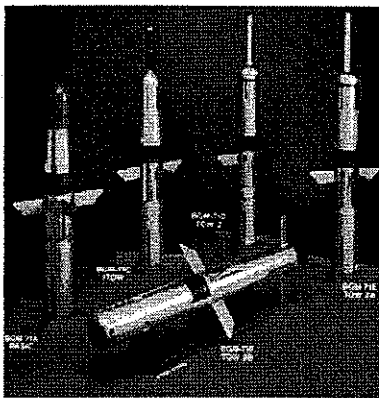
DOE has stated that it prefers using rail shipments but rail lines connecting all of the nuclear reactor sites do not yet exist and most nuclear spent-waste casks are too heavy for road transport. Consequently, there are proposals for significant barge-shipment down the nation's coastlines and waterways. DOE's estimates from 2002 show a total of roughly 3,000 barge shipments on proposed routes past New York City and Staten Island, along the coast of Southern California, to the ports of Boston, New Haven and Baltimore, around Cape Cod, on Lake Michigan, down the Missouri, Mississippi and Tennessee rivers, and around the coasts of Florida. (1)

Problems with Transport

Accidents

Even DOE, which assumes human error will not affect the probability or severity of accidents, predicts 66 truck or 10 rail accidents. Based on the actual record of past spent fuel shipments, other experts estimate there will be 130 truck accidents or 440 rail accidents over 40 years. (1)

"tens of thousands of tons of highly hazardous nuclear waste is going to have to cross through 45 states, the District of Columbia, and through or near virtually every major American city"



Picture of various TOW missiles, provided by NAMSA

(<http://www.namsa.nato.int/gallery/systems/tow-22.jpg>)

According to the U.S. Department of Transportation, an accident could result in cask failure and the release of radioactivity, producing high human and financial costs. (3) For example, a train accident such as the summer 2001 Baltimore tunnel fire would have resulted in cask failure and the release of radioactive materials, causing thousands of deaths and \$10-\$14 billion in cleanup costs. (1, 3) The Baltimore train tunnel remains a DOE-approved eligible transportation route for nuclear waste.

Furthermore, any accidents on barges run the risk of initiating an actual nuclear reaction between spent waste fuel from light water reactors and the water it is being carried down, putting millions of people at risk from both contamination of water sources and possible nuclear reactions dangers. (4)

Radiation in Transit

Even without an accident, the NRC approved casks continuously emit low levels of radiation, posing a direct risk to transportation workers and members of the public living or traveling in the vicinity of the transportation routes. The National Academy of Sciences (NAS) has recently produced a report declaring that no dose of ionizing radiation, no matter how small, is safe. (5)

Attack

On June 25, 1998 the U.S. Army conducted a weapons test depicting the vulnerability of nuclear waste storage casks. The tested model, a GNB dual-purpose CASTOR, one used in both dry storage and transport, was successfully pierced during the tests by a TOW armor piercing anti-tank missile warhead. Had there been spent fuel inside, a serious release of radioactivity would have occurred. (6)

The TOW is the most widely distributed anti-tank guided missile in service around the world and weighs less than fifty pounds, certainly a size small enough for a mobile attack effort from terrorists. The CASTOR is among the most robust models of nuclear waste storage in use; it is 15

inches thick while many other models in use in the U.S. are only a few to several inches thick. The CASTOR can also hold over 200 times the long-lasting radioactivity released by the Hiroshima bomb. (6) Moving enough waste for 200 Hiroshimas per cask through most major U.S. cities poses terrifying possibilities for a terrorist attack. (7)

Cost

The NWPA established that the majority of the costs for a repository construction would come from funds set aside in the Nuclear Waste Trust Fund that currently holds about \$18 billion. DOE has already spent \$8 billion of this money dealing with the weaknesses and dilemmas of the Yucca Mountain site. The last DOE estimate from 2001 projected a cost of \$60 billion for the repository construction and operation based on the optimistic opening date of 2010 which is inconceivable today. (8) The Caliente Rail construction in Nevada alone will cost over \$2 billion. (9) Costs will most likely balloon as the delays continue.

DOE has also not yet secured funding for state and local governments to create, equip, train and maintain adequate emergency response teams. (10) Before any waste is transported, DOE must make sure that every community along the transportation routes, both land and water, is ready to respond to any sort of radiological accident that might occur.

February 2006 NAS Transport Report

The NAS produced a report on the transport of spent nuclear fuel and high-level radioactive waste in the U.S. that concluded that while transport is technically possible, a safe transportation program is extremely difficult to create. Beyond the technology, it must also be well planned and managed, with stringent regulations carefully enforced, over the entire period of the transportation program.

Main Points of Report:

- The need for full scale crash testing of transport packages under severe accident conditions;
- Study of security issues from an independent examiner;
- Study of very long duration fires because extreme accident scenarios involving such fires could compromise the waste containers, and to implement operational controls and restrictions to reduce the likelihood of such conditions, including carefully discerning transportation routes;
- The committee expressed concerns about DOE's ability to plan and manage a safe program and details them through a series of points about rail construction, routes, emergency responder preparedness responsibilities, and timely access to information that does not require protection;

Other government bodies must be involved including: the Nuclear Regulatory Commission, the Department of Transportation, the Department of Homeland Security, and state, local and tribal governments. All must play a central role in any waste transportation program's planning and implementation.

The committee also states that opposition to a transportation program and questions about its safety and competence are completely rational and cannot be dismissed as an unreasonable fear of radiation. (11)

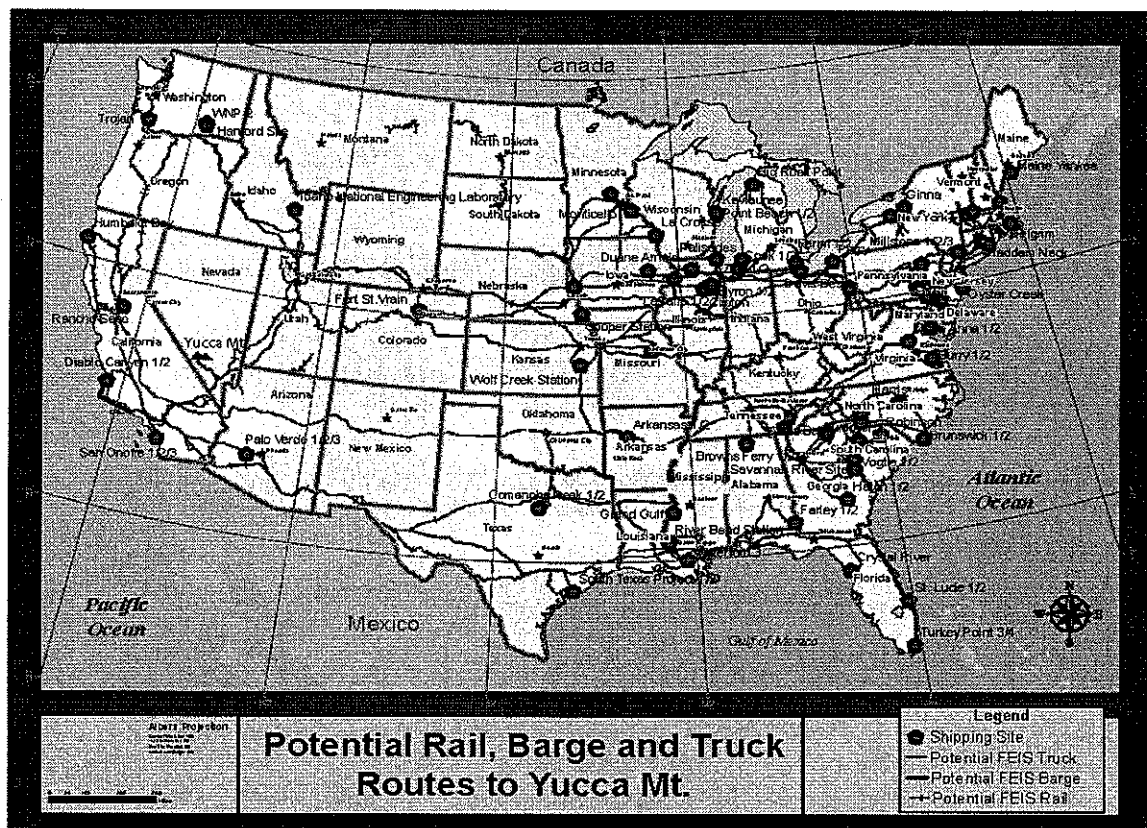


Diagram provided by NIRS (<http://www.state.nv.us/nucwaste/maps2002/roadrail/index.htm>)

Conclusion

No pending crisis requires either the immediate transportation of or the opening of a faulty repository at Yucca for the nuclear waste at its present locations. Current hardened dry cask storage technology, considered safe and economical by NRC, can be used to store spent nuclear fuel in its current locations until an appropriate long-term storage solution can be identified and agreed to. This is a solution that is also proposed in a bipartisan bill currently being promoted by Senators Harry Reid and John Ensign on Nevada. When it does come time for the transport of high-level nuclear waste, the NAS Transport Report of February 2006 follows guidelines that thus far best protect the public's health and safety.

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Through its educational efforts and policy proposals, the Center seeks to develop long-range policies for the United States that reduce the threat of terrorism and war, increase international cooperation and respect for international law, and build a healthy, just, secure and sustainable future for our citizens and others around the world. The PSR Center for Global Security and Health has published a report *New Nuclear Weapons and the War on Terrorism: Counterproliferation, Nuclear Doctrine and the Chemical and Biological Weapons Threat*, that examines these issues in greater depth.

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Resources

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Yucca Mountain Tunnel

(<http://www.yuccamountain.org/image/tunnel02.jpg>)

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A New Level of Hazardous Risk 2005 EPA Standards for Yucca Mountain

Erin Blankenship, *Scoville Peace Fellow*

FACT SHEET

Background

Based on the National Academy of Sciences (NAS) recommendations, Congress agreed that geologic disposal was the safest option available for dealing with high-level nuclear waste. Per this understanding, Congress designated the Department of Energy (DOE) as responsible for the development and operation of a permanent high-level nuclear repository and designated the Environmental Protection Agency (EPA) and the Nuclear Regulatory Commission (NRC) to share responsibility for regulating the program and to ensure protection of public health and safety.

Through the Energy Policy Act of 1992, Congress required of EPA that its public health and safety standards be "based on and consistent" with the recommendations of the NAS.

This includes:

- EPA radiation protection standards must comply with the risk standard for radioactive waste and be applied at the time of peak risk, whenever it occurs.
- Intergenerational equity must be recognized and protected by considering health and safety protections during periods longer than 10,000 years.

Original EPA Standards for Yucca

EPA first released its standards in 2001. These were criticized widely and legally challenged by the State of Nevada and various environmental groups for being contrary to the recommendations of NAS. The standards would only cover the first 10,000 years for the repository operation, ending well before the peak risk period. NAS explicitly rejected this 10,000 year cut-off time as arbitrary and said that the standards must be met at the "time of peak risk, whenever that occurs... [and which] might occur tens to hundreds of thousands of years or even farther into the future."⁽¹⁾

Even DOE has publicly estimated radiation doses of 250 millirem per year at 200,000 to 300,000 years in the future. For this reason, in 2004 the U.S. Court of Appeals in DC ruled that EPA must develop new standards that would adequately protect public health for up to 1 million years.

“a radiation exposure-limit of 350 millirem/yr is a 2,300% exposure increase over what is permitted for the first 10,000 years”

The EPA proposed rule does not account for the disproportionate radiation level exposure risks to children

Revised EPA Rules

Following the court's order, EPA issued a revised set of rules in August 2005. EPA's proposed new rules include:

- Two-tiered standard that covers radiation limits at 15-25 millirem/yr out to 10,000 years
- Opens up the radiation protection limit to 350 millirem/yr for any time beyond the 10,000 years up to 1 million years.

EPA is presently finalizing these rules after having received public comments.

Cause for Concern

Standards Themselves

EPA's 2005 standards are worse than its original proposal and represent a dramatic reversal of U.S. and international public health standards. EPA's new rules propose a “two-tiered standard system.” For the first 10,000 years, EPA rules permit a 15 millirem/yr dose limit from Yucca. But beyond 10,000 years, EPA sets a radiation exposure-limit of 350 millirem/yr, a 2,300% exposure increase over what is permitted for the first 10,000 years. (2) For decades EPA has argued that any radiation dose above 15-25 millirem/yr is “non-protective of public health” and that doses above 100 millirem/yr produce unacceptable levels of risk. A 350 millirem/yr exposure limit, albeit for future generations, is unconscionable and vastly outside what even the current EPA rules suggest is dangerous to public health. This dosage over one's lifetime, according to recent NAS reports on radiation risks, will cause cancer in approximately one out of every twelve people exposed. This is vastly outside the 1-in-10,000 to 1-in-a-million risk range EPA has used as a basis for establishing radiation exposure limits.

Other Problems with the EPA 2005 Standards

Method of Assessment

EPA's new rules also propose using two different methods for assessing regulatory compliance: the first 10,000 years will be measured using the arithmetic mean, while beyond that they will use a median dose. By switching to a median dose, half of the radiation scenarios could result in doses grossly exceeding 350 millirem/yr. In fact, by using the median dose method, half of the population could suffer from having no maximum limit for exposure. This median dose distribution method for risk assessment is so flawed that it has been rejected by scientists worldwide.

Children's Health

The EPA proposed rule does not account for the disproportionate radiation level exposure risks to children. It is widely understood that “children suffer disproportionately from environmental health risks and safety risks” (Executive Order 13045 EPA 2005), meaning the same dose of radiation will produce more cancers in kids than adults. This omission is out of order with Executive Order 13045 on Children's Environmental Health which requires such attention by federal agencies.

“Background” Exposure

EPA defends its 350 millirem/yr exposure limit as an acceptable level of risk because it is only slightly higher than what some people already receive from natural-background radiation. While that number is already skewed by the presence of radon, EPA's proposed rule does not take into account that the radiation received from Yucca will be in addition to, not in place of, background radiation. Furthermore, these doses of radiation would not be momentary and then recede to lower levels. Instead they would be allowed to occur for thousands of generations. (3) Moreover, in a recent report, the NAS declared that no dose of ionizing radiation is completely safe, no matter how small or how natural. (4)

Intergenerational Equality

EPA's proposal for a two-tiered radiation protection standard and two different methods for assessing regulatory compliance is not only scientifically questionable, it is also unethical and a gross violation of current EPA regulations and internationally accepted public health norms that guarantee *all* individuals *equal protection* against all radiation exposure above the legal limit without an arbitrary division at 10,000 years.

Water Quality Protection

The 2005 EPA proposed rules are not in compliance with the current Safe Drinking Water Act, which limits radiation in drinking water to 4 millirem/yr. If approved, this standard will only be required for the first 10,000 years. Beyond that, EPA switches to a 350 millirem/yr all pathway exposure limit. This means that much higher levels of radiation could be allowed in drinking water. Yucca Mountain is above an aquifer; the radioactive wastes, which will remain hazardous for hundreds of thousands of years, could likely leak into this underlying water source, which will become the primary pathway for harmful doses of radiation to people "downstream" and throughout the arid west.



Yucca Mountain (<http://www.yuccamountain.org/image/yucca03.jpg>)

Conclusion

The present Yucca Mountain nuclear waste proposal is a fundamentally flawed plan. The revised standards will only make a bad situation worse. The 2005 EPA proposed rule for Yucca drastically relaxes current regulatory standards for radiation protection and would have consequences far beyond the Yucca Mountain Repository. It would also set a dangerous precedent for relaxation of all radiation protection standards at DOE sites everywhere. (5) Furthermore, if accepted, EPA's proposed standards would be, by far, the worst standards among those of all developed nations.

PSR asserts that the newly proposed EPA radiation standards are extremely dangerous, unethical and illegal.

*-Dr. Michael McCally
Senate Staff Briefing on
Yucca Mountain,
February 27, 2006*

Based on these concerns:

- The proposed EPA radiation protection standards for Yucca Mountain will create damage to public health and the environment. Moreover, the proposed rules appear to be unscientific, unethical and illegal.
- EPA's proposed rules should be revised to keep radiation exposure limits to less than 15-25 millirem/yr for as long as the stored nuclear waste remains toxic to human health. In addition, EPA should enforce a separate groundwater protection standard of less than 4 millirem/yr for the period beyond 10,000 years.

In managing the risks of storing the deadliest nuclear waste, the Environmental Protection Agency should embrace its original mission — to provide the strictest possible health protections for current and future generations.

Please visit our webpage: www.psr.org

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"Dry spent fuel storage in casks is considered to be safe and environmentally sound. Over the last 20 years, there have been no radiation releases which have affected the public, no radioactive contamination, and no known or suspected attempts to sabotage spent fuel casks."

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Dealing with Spent Nuclear Waste Dry Cask Storage: A Viable Option

Erin Blankenship, Scoville Peace Fellow

FACT SHEET

It is widely recognized by the scientific, national and international communities that nuclear waste poses an extremely hazardous threat to public health and the environment. The question of how to deal with our nuclear waste is a pressing and controversial issue that dominates the ongoing debate over national energy policies.

Background

Nuclear power plants' fuel is stored in rods. Periodically, about one-third of the nuclear fuel in an operating reactor needs to be unloaded and replaced with fresh fuel. The rods containing the already used-fuel are known as "spent fuel." The spent fuel is stored in water pools at the reactor site. (1)

Most of today's growing inventory, about 40,000 metric tons of spent fuel, is stored onsite at the reactor where it was produced in spent fuel storage pools. (2) Since the 1970s, the need for alternative storage grew as pools at many nuclear reactors began to approach their capacity with stored spent fuel. It is estimated that by the end of 2006, approximately 60 facilities will have no more storage space in spent fuel pools. (3)

The passage of the Nuclear Waste Policy Act of 1982 established the federal policy for disposal of high-level radioactive wastes generated as byproducts of U.S. nuclear weapons production and from nuclear power plants in a deep "geological" repository. Because a suitable repository has not yet been approved, utilities began looking at options for increasing spent fuel storage capacity. Current regulations permit re-racking (placing fuel rod assemblies closer together in spent fuel pools) and fuel rod consolidation, subject to the U.S. Nuclear Regulatory Commission's (NRC) review and approval, to increase the amount of spent fuel that can be stored in a pool. (1)

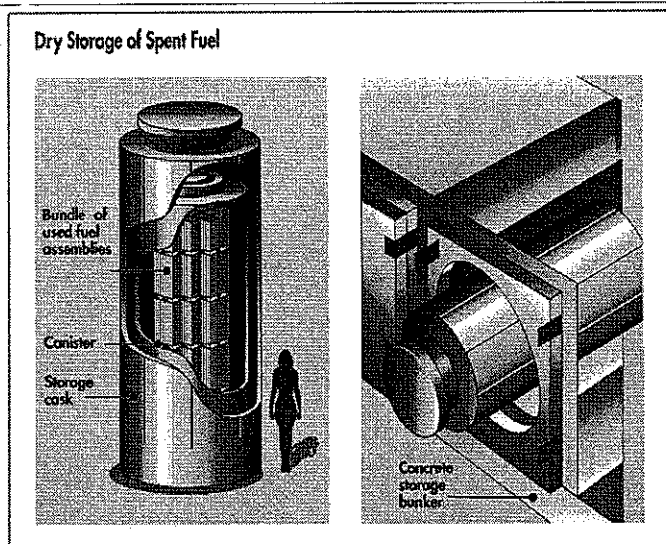
Dry Cask Storage

Even with re-racking the spent fuel pools will not be capable of accommodating all spent fuel expected to be produced by currently operating power plants. It is inevitable that additional on-site or other interim storage will be needed for most nuclear reactors until a permanent site can be chosen and

constructed. The primary technology being considered today is the use of dry storage casks. (3)

Dry cask storage allows spent fuel that has already been cooled in the spent fuel pool to be surrounded by inert gas inside a container called a cask. NRC requires the spent fuel to be cooled in the pool for several years before being transferred to dry casks. (1)

Casks typically consist of a sealed metal cylinder that provides a leak-tight containment of the spent fuel. Each cylinder is surrounded by additional steel, concrete, or other material to provide radiation shielding to workers and everyone else. (4) Casks can be placed horizontally or set vertically on a concrete pad. The casks used in the dry storage systems are designed to resist floods, tornadoes, projectiles, temperature extremes, and other unusual scenarios. The safest available design for dry cask storage is what is called hardened dry-cask storage, where the cask is enclosed in a concrete bunker underground.



Picture 1 shows the general model and size of a dry-cask container, the second shows the general idea of its storage in a concrete bunker.

As ruled by Congress in the Nuclear Policy Act, all dry-cask designs and use must be approved by NRC. (4) Dry casks must also be continually monitored for radiation leakage and re-licensed by NRC every 20 years. The NRC also periodically inspects the design, fabrication, and the use of dry casks, to ensure licensees and vendors are performing activities in accordance with radiation safety and security requirements, and licensing and quality assurance program commitments.

Recent Dry Cask Policy

As approved by the Nuclear Regulatory Commission, dry cask containers can safely store waste for at least one-hundred years and are already used at thirty-three nuclear power sites throughout the country. On December 16, 2005, Senators Harry Reid and John Ensign introduced legislation, co-sponsored in the House, mandating that nuclear waste be stored on site where it is produced and requiring that the federal government take responsibility for the possession, stewardship, maintenance and monitoring of the nuclear waste. (7)

Conclusion

Dry cask storage is a viable solution for dealing, at least temporarily, with our national nuclear waste problems. While complete safety may be unattainable when dealing with the extreme hazard represented by the intense radioactivity of irradiated fuel no matter what the storage technology, using a passive dry storage system is better than having to rely on active mechanical systems of spent fuel pools that can wear out, malfunction or break down. It is also better than rushing the country into false solutions like the faulty Yucca Mountain Repository. The NRC's testing and quality control have shown that dry cask technology is completely safe for up to 100 years. The DOE should utilize this time and opportunity to devise truly safe methods of disposal as well as to contemplate the potential health and safety consequences of our further use of nuclear energy.

Dry cask storage is a good idea because:

Dry spent fuel storage in casks is considered to be safe and environmentally sound. Over the last 20 years, there have been no radiation releases which have affected the public, no radioactive contamination, and no known or suspected attempts to sabotage spent fuel casks. (1)

- Since dry casks do not contain water, which is necessary to enable a nuclear reaction in light water reactors, there is no chance of an accidental chain reaction, as there would be in water storage pools. (5)
- Because there is no water circulation and filtering, no "low-level" radioactive waste is produced by fuel storage, as is continually the case in the fuel pools.
- Dry-cask storage systems are, for the most part, self-contained, with no mechanical pumps or other active systems, the maintenance of safety relies passively on the cask integrity. (5)

As the 2005 National Academy of Sciences concluded, terrorist attack on spent fuel pools could lead to the release of large quantities of radioactive materials into the environment; dry cask storage offers inherent security advantages over pool storage. (6)

Using dry cask storage would ease the drive to push forward the approval of a permanent high level nuclear repository at a site that does not meet public health and safety standards. It would allow the time to find the safest possible site and, "develop a sensible national policy on nuclear energy." (7)

Resources

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Assembly Committee on Energy and Utilities Testimony on Assembly Bills 346, 347 and 348

By Robert Seitz, Executive Director, Wisconsin Utility Investors, Inc.

I am Bob Seitz and I am Executive Director of the Wisconsin Utility Investors, Inc. With me is WUI Chairman Roger Cole. Thank you Chairman Montgomery and members of the Committee for taking up Assembly Bills 346, 347 and 348 which give Wisconsin policy-makers the full range of options and information they will need to meet our energy challenges.

WUI supports all three bills and considers them a package of reforms that allow Wisconsin's system for developing and implementing sound energy policy to function. With this in mind, we will testify in favor of all three bills together.

Wisconsin has a system in place that has been a model for other states in developing an energy policy that protects the environment and consumers while allowing investor-owned utilities the opportunity to produce a reasonable return for investors.

We may not agree with every decision of Wisconsin's Public Service Commission. But, we respect and appreciate the fact that Wisconsin has a body whose purpose is to plan for and implement policy that provides Wisconsin with clean, safe, economical, reliable energy. The PSC has the mechanisms in place to consider all the factors that go into developing Wisconsin's energy mix.

I have always wondered why we trust them in every decision but one. The Public Service Commission must pretend that the energy source for one-fifth of the electricity in Wisconsin and the United States does not exist to meet future demand growth. The body we established as experts to take a non-partisan look at all of the issues affecting energy is required, by statute, to close their eyes and plug their ears when anyone mentions nuclear energy as a future option for Wisconsin.

We have heard opponents frantically telling us we need to keep the moratorium in place because nuclear power is such an obviously bad idea. I would ask opponents of these bills: If nuclear is such a bad idea, why do you need a moratorium? There is nothing in these bills mandating new nuclear generating facilities. Nothing in here that tips the scales unfairly toward this option.

When I hear frantic opposition to even considering science, it makes me think nuclear opponents are afraid of what that science might show the public. Moratoriums on thought and fact and science never work. Once upon a time, people tried to put a moratorium on considering scientific alternatives to a flat earth.

If the Legislature ever considers mandating that Wisconsin build nuclear plants, WUI will be here opposing that legislation. We aren't asking for one solution or another. We ask that all the options be put on the table so Wisconsin can arrive at the best solution.

Assembly Hearing for the committee on Energy and Utilities

**Tuesday, Dec 18th 2007
10:00 AM, 412 East, State Capitol**

Thank you for the opportunity to provide testimony this morning. My name is Roger Cole, my home address is, E12805 West Point Drive, Merrimac, WI. 53561. I presently serve as Chairman of the Wisconsin Utility Investors (WUI) serving over 16,000 members. WUI is an independent non-profit organization, comprised of shareholders of Wisconsin's five investor owned Electric Utility Companies.

I am here today to voice my support for three bills that are being considered on nuclear energy. These bills are AB 346, 347, 348-

Regardless of what we attribute global climate change to, reduction of CO2 emissions is the law of the land. We do not think we can overlook any of the options that are available to the state when it comes to providing reliable electrical generation that attempts to meet new emission standards. According to the Nuclear Energy Institute in Washington DC, the state has grown at an average rate of 1.9 percent ~~rate~~ over the past five years. To keep the economy growing the state will need to have new sources of power, regardless of how successful we are in promoting conservation and maximizing renewables. In the next few years we are looking at the possibility of building additional base load generating facilities in the state. We know that several area's in the state already experience poor air quality from time to time and it would be irresponsible not to be able to consider every option that we have, including nuclear. We feel that the nuclear option must be in the mix as it is an emission free source of energy that is proven to be reliable and safe. We strongly support lifting the limits on nuclear energy.

This fall we held several regional membership meetings across Wisconsin, with small individual investors, who make up WUI. We found great support and urgency for allowing nuclear energy to be considered in meeting Wisconsin's future energy needs.

On behalf of the Wis. Utility Investors I would like to thank you for your time and consideration.

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Daniel E. Sherman, Business Manager

December 18, 2007

TO: Assembly Energy & Utilities Committee

CONTACT: IBEW Local 2150, Forrest Ceel at 262-252-2552 ext. 223

State's Largest Electrical Union Supports Nuclear Power Bills

Local 2150 of the International Brotherhood of Electrical Workers (IBEW Local 2150) is the largest labor organization representing energy and utility workers in Wisconsin. Of our 4,800 members, 450 of them work at the largest nuclear plant in Wisconsin, Point Beach Nuclear Plant. Our members at Point Beach include mechanics, electricians, operators, engineers, technicians, and clerical, and other support occupations. It is their expertise and dedication that have helped provide greenhouse gas free emissions since 1970.

The State is currently debating energy policy in regards to reducing the level of carbon dioxide output from electric generating stations. The debate should rightfully include nuclear power since it contributes zero global warming gases to the atmosphere. The future is likely to include cleaner coal technologies, thousands of megawatts of wind and solar power, and continued reliance on hydroelectric power. Natural gas will continue to be the best option for peak demand days for electricity. In order to substantially cut emissions, nuclear power must be part of the generating mix.

IBEW Local 2150 has previously testified in support of nuclear power as the best base load option for reliability and emissions control. The three bills before the legislature are thoughtful in their approach to the nuclear dilemma that Wisconsin has placed itself in since the early 1980's. Each bill addresses a different aspect of nuclear power's impact on the state's energy future.

AB 346 gets to the heart of needing to provide base load power to Wisconsin. AB 346 does not provide for getting any nuclear plants built in Wisconsin. All the passage of AB 346 would do is make a proposal to build a nuclear plant under the same scrutiny as all other generating stations under consideration by the Public Service Commission. The Commission would be required to assess all factors, including economic and environmental, just as they would for other generating station proposals.

AB 347 is only common sense. A crucial element to the reliability of the base load power for Wisconsin is the 1,500 plus megawatts of power flowing out of Point Beach and Keweenaw. If those base load sources are phased out, they will need to be replaced not only to maintain reliability, but also with a base load source that does not contribute carbon dioxide, mercury, and other harmful emissions.

AB 348 directs the PSCW to be an advocate for addressing fuel storage needs rather than a passive entity waiting for Washington to act. Having the PSC join with other states engaging Congress and the Executive branch to act will hasten the day when at least the existing spent fuel will have a storage facility.

In summary, IBEW Local 2150 supports all three bills and believes that they are consistent with the state's goals of guaranteeing reliable power and reducing the impact of global warming.

Help Keep More Nuclear Reactors Out of Wisconsin

Please contact your State Legislators and urge them to *Vote No* on **Assembly Bill (AB) 346** — repeal of the common sense law that protects the public from unnecessary new nuclear power reactors in Wisconsin (state statute 196.493).

If passed, the repeal would encourage more nuclear power in Wisconsin and increase the likelihood that the state will become a national high-level nuclear waste dumpsite.

If passed, the repeal would eliminate two legal requirements that must now be met before new reactors can be built in Wisconsin:

1) That a federal nuclear waste storage site must be in operation; and 2) that reactor-generated electricity must be economically advantageous to the ratepayer compared with alternatives.

A special Nuclear Power Committee and the Wisconsin Legislative Council have recommended repeal of these precautionary, conservative requirements. Their effort is part of an industry push for more reactors and radioactive waste production nationwide. Pro-nuclear propaganda has it that nuclear power is "cheap" and "carbon free." But nuclear waste management will cost hundreds of billions of dollars over a period of at least 300,000 years; and the mining, milling and production of reactor fuel creates millions of tons of carbon pollution that the industry ignores.

The proposed Yucca Mountain dump site in Nevada is unfit and should never open. One Nuclear Regulatory Commission member said Feb. 7, 2007 that the Yucca project must be scrapped. This would put Wisconsin higher on the list of potential dump sites, especially if tons of new waste is produced by new reactors.

The time to express your opinion is now. Please call, write, email and/or visit your legislators as soon as possible.

Legislative Hotline: 800-362-9472.

Nukewatch

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Wisc. Nuclear Reactors Repeatedly Fined for unsafe operations

Only four "red" findings (the highest safety failure warning in the industry) have been issued by the Nuclear Regulatory Commission (NRC) – two of them to Point Beach owners Wisc. Electric Power Co. (WEPCO)

October 30, 2004

A worker was contaminated inside the Kewaunee reactor and was rushed to the hospital after on-site decontamination attempts failed. The NRC said it did not know what isotopes had been involved. (NRC notification, 10/30/04; NRC Region 3 phone interview, 11/16/04)

March 20, 2004

The NRC fined Point Beach \$60,000 for problems with the reactor's backup cooling pumps last summer. (*The Capital Times*, 3/20/04)

October 2002

A second "Red" finding by the NRC against Point Beach for problems with cold water circulation for cooling the reactor. (*NRC News*, 2/11/04)

2001

Risk of breakdown in Point Beach's cooling feedwater pumps results in a "Red" finding. (*NRC News*, 2/11/04)

June 5, 2001

Kewaunee's reactor was shut down when the computer Safety Parameter Display System and Emergency Response Data System both failed. The operators did not know the status of "emergency response availability." (NRC Event Notice #38052, 6/5/01)

Nov. 18, 1997

Point Beach Unit 2 was hastily shut down because of electrical

problems. (*Mlwk Journal Sentinel*, 11/18/97)

Aug. 12, 1997

NRC recorded 21 violations at Point Beach in the 90-day period between Dec. 1996 and Feb. 1997. (*St. Paul Pioneer Press*, 8/12/97)

July 25, 1997

Reactor number 2 at Point Beach was shutdown when a cooling water pump failed. (*Mlwk Journal Sentinel*, 8/25/97)

Feb. 18, 1997

Reactor 1 at Point Beach was shut down when cooling water pump defect required pump replacement.

Dec. 1996

WEPCO fined \$325,000 for 16 safety violations and a 1996 explosion inside a loaded high-level waste cask. (*Mlwk Journal Sentinel*, 8/12/97) The NRC said WEPCO was "inattentive to their duties," "starting up a power unit while one of its safety systems was inoperable," and had failed to install "the required number of cooling pumps." (*Mlwk Journal Sentinel*, 12/5/96)

Sept. 21, 1996

Kewaunee reactor was shut down when "more than expected" corroded steam tubes were discovered. (*Mlwk Journal Sentinel*, 2/26/97)

May 28, 1996

A potentially catastrophic explosion of hydrogen gas, "powerful enough to up-end the 3-ton lid," pushed aside a 6,390-pound cask lid while it was atop a cask filled with high-level waste. (*Mlwk Journal Sentinel*, 6/8/95)

March 30, 1995

Point Beach reactor shut down due to instrument failure in the emergency generator system used to circulate cooling water when regular power is cut off during emergencies. (*Wisc. State Journal*, 3/30/95)

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In Opposition to AB 346, Repeal of Safeguards on
Approving New Nuclear Power Plants
Before the Assembly Committee on Energy and Utilities
Statement by Caryl Terrell, Chair, Legislative Committee
December 18, 2007

Due to attending the Governor's Global Warming Task Force meeting today, I am unable to present this testimony in person.

State Statute 196.493 provides a practical, common sense threshold for approving new nuclear power plants in Wisconsin. This law has been on the books for over twenty years and it has served us well. **We urge defeat of AB 346 which would repeal this statute.**

Nuclear power plants create a very toxic, long lived waste. It only makes sense that we know how it will be disposed safely before new generation is approved.

Why is this statute so important to the health and well-being of Wisconsin citizens? Oversight of nuclear generation in Wisconsin is being eroded. Kewaunee NPP was sold to an out-of-state corporation and the Wisconsin owners of the Point Beach NPP have applied to sell it to an out-of-state corporation. This means the regulation of nuclear power generated near Wisconsin communities will no longer be subject to the Public Service Commission. The risks of accidents and the liability for waste disposal will still impact Wisconsin residents, but a federal bureaucracy is not as likely to protect Wisconsin ratepayers as well.

Why is nuclear power receiving attention now? President George W. Bush has called for building 50 more nuclear power plants as a solution to the environmental dangers he now admits are posed by coal burning power plants. Nuclear power is a dangerous energy source that creates more problems than it solves. Despite claims that nuclear power plants generate little or no CO₂, the whole nuclear fuel cycle (from mining through long-term storage) poses public risks, ultimately uses more energy than the nuclear power plants generate, and produces CO₂.

The generous federal subsidies and incentives adopted by Congress are a green flag to investors in new nuclear power plants. Repealing Wisconsin's common sense threshold law will be a green flag for federal re-consideration of the Wolf River Batholith as a potential high-level nuclear waste repository. A large nuclear waste dump on the headwaters of the pristine Wolf River would pose an unacceptable public health and environmental risk. This is a special place for us and for people from all over the country who come to the Wolf River to fish for wild trout and enjoy excellent river sports such as whitewater rafting and kayaking.

Ironically Wisconsin is beginning to pursue energy efficiency and renewable energy, our quickest and cleanest alternatives to polluting fossil fuels, risky nuclear power and foreign sources of energy. We urge the Assembly Energy and Utilities Committee to reject AB 346. Please turn your attention instead using available technology to produce more of our energy with clean, renewable sources like wind and solar power, to increase efficiency of buildings and transportation, and to make Wisconsin a leader in solving global warming.

Science FOR Democratic Action

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No. 39

Carbon-Free and Nuclear-Free *A Roadmap for U.S. Energy Policy*

BY ARJUN MAKHIJANI, Ph.D.¹

A three-fold global energy crisis has emerged since the 1970s; it is now acute on all three fronts:

1. *Climate disruption:* Carbon dioxide (CO₂) emissions due to fossil fuel combustion are the main anthropogenic cause of severe climate disruption, whose continuation portends grievous, irreparable harm to the global economy, society, and current ecosystems.
2. *Insecurity of oil supply:* Rapid increases in global oil consumption and conflict in and about oil exporting regions make prices volatile and supplies insecure.
3. *Nuclear proliferation:* Non-proliferation of nuclear weapons is being undermined in part by the spread of commercial nuclear power technology, which is being put forth as a major solution for reducing CO₂ emissions.

After a decade of global division, the necessity for drastic action to reduce CO₂ emissions is now widely recognized, including in the United States, as indicated by the April 2007 opinion by the U.S. Supreme Court² that CO₂ is a pollutant and by the plethora of bills in the U.S. Congress. Many of the solutions offered would point the United States in the right direction, by recognizing and codifying into law and regulations the need to reduce CO₂ emissions. But much more will be needed. Moreover, most of the solutions being offered are likely to be inadequate to the task and some, such as the expansion of nuclear power or the widespread use of food crops for making fuel, are likely to compound the world's social, political, and security ills. Some, like production of biofuels from Indonesian palm oil, may even aggravate the emissions of CO₂.

Our report, which this issue of SDA summarizes, examines the technical and economic feasibility of achieving a U.S. economy with zero-CO₂ emissions without nuclear power. This is interpreted as an elimination of all but a few percent of CO₂ emissions or complete elimination with the possibility of removing from the atmosphere some CO₂

U.S. Navy 750 kW Parking Lot Solar PV Installation near San Diego

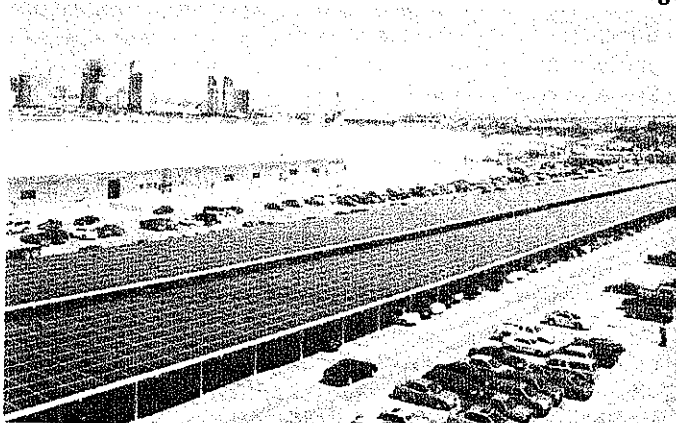


Figure 1

Courtesy PowerLight Corporation

CENTRAL FINDING

The overarching finding of the study on which this issue of SDA is based is that a zero-CO₂ U.S. economy can be achieved within the next thirty to fifty years without the use of nuclear power and without acquiring carbon credits from other countries. In other words, actual physical emissions of CO₂ from the energy sector can be eliminated with technologies that are now available or foreseeable. This can be done at reasonable cost while creating a much more secure energy supply than at present. Net U.S. oil imports can be eliminated in about 25 years. All three insecurities – severe climate disruption, oil supply and price insecurity, and nuclear proliferation via commercial nuclear energy – will thereby be addressed. In addition, there will be large ancillary health benefits from the elimination of most regional and local air pollution, such as high ozone and particulate levels in cities, which is due to fossil fuel combustion.

that has already been emitted. We set out to answer three questions:

- Is it possible to physically eliminate CO₂ emissions from the U.S. energy sector without resort to nuclear power, which has serious security and other vulnerabilities?
- Is a zero-CO₂ economy possible without purchasing offsets from other countries – that is, without purchasing from other countries the right to continue emitting CO₂ in the United States?
- Is it possible to accomplish the above at reasonable cost?

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The achievement of a zero-CO₂ economy without nuclear power will require unprecedented foresight and coordination in policies from the local to the national, across all sectors of the energy system. Much of the ferment at the state and local level, as well as some of the proposals in Congress, are already pointed in the right direction. But a clear long-term goal is necessary to provide overall policy coherence and establish a yardstick against which progress can be measured.

A zero-CO₂ U.S. economy without nuclear power is not only achievable—it is necessary for environmental protection and security. Even the process of the United States setting a goal of a zero-CO₂ nuclear-free economy and taking initial firm steps towards it will transform global energy politics in the immediate future and establish the United States as a country that leads by example rather than one that preaches temperance from a barstool.

A zero-CO₂ U.S. economy without nuclear power is not only achievable—it is necessary for environmental protection and security.

The tables on pages 8–10 provide a sketch of the roadmap to a zero-CO₂ economy with estimates of dates at which technologies can be deployed as well as research, development, and demonstration recommendations.

A summary of our main findings can be found on the back page.

Editor's note: The Institute for Energy and Environmental Research has boldly gone where none other has gone before. In partnership with the Nuclear Policy Research Institute, IEER will publish in August 2007 a groundbreaking scientific study: A roadmap to how the United States can achieve CO₂ reductions – down to zero – while phasing out nuclear power. This special issue of *Science for Democratic Action* serves as the Executive Summary of that report which will be published as a book in October. Additional resources, including a guide for elected officials to a zero-CO₂, non-nuclear U.S. economy, will be available on IEER's web site, www.ieer.org, in the near future.

Author's note: I would like to thank the Nuclear Policy Research Institute for having sponsored the project that will result in the book on which this issue of *Science for Democratic Action* is based. Helen Caldicott was the star who raised the funds, provided critical comments and suggestions, and had the vision that this study should be done because it is urgently needed. Helen's and S. David Freeman's presentations at NPRI's 2006 energy conference and our private discussions afterwards inspired me to write the book.

Thank you to Julie Enszer for smoothly shepherding this project from beginning to end. I also wish to thank Hisham Zerriffi, Jenice View, and Paul Epstein, who, as members of the Advisory Board of the project (in addition to Helen and Dave and others), contributed valuable insights and criticisms of the draft manuscript and this summary. However, they may or may not agree with the recommendations or conclusions in this summary. The book will contain statements from Board members who wish to comment. Full acknowledgements will appear in the book.

SEE CARBON-FREE ON PAGE 3, ENDNOTES PAGE 14.

Science for Democratic Action

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Main Findings

Finding 1: A goal of a zero-CO₂ economy is necessary to minimize harm related to climate change.

According to the Intergovernmental Panel on Climate Change, global CO₂ emissions would need to be reduced by 50 to 85 percent relative to the year 2000 in order to limit average global temperature increase to 2 to 2.4 degrees Celsius relative to pre-industrial times. A reduction of 80% in total U.S. CO₂ emissions by 2050 would be entirely inadequate to meet this goal. It still leaves U.S. emissions at about 2.8 metric tons per person.

A global norm of emissions at this rate would leave worldwide CO₂ emissions almost as high as in the year 2000.³ In contrast, if a global norm of approximately equal per person emissions by 2050 is created along with a 50 percent global reduction in emissions, it would require an approximately 88 percent reduction in U.S. emissions. An 85 percent global reduction in CO₂ emissions corresponds to a 96 percent reduction for the United States. An allocation of emissions by the standard of cumulative historical contributions would be even more stringent.

A U.S. goal of zero-CO₂, defined as being a few percent on either side of zero relative to 2000, is both necessary and prudent for the protection of global climate. It is also achievable at reasonable cost.

Finding 2: A hard cap on CO₂ emissions—that is, a fixed emissions limit that declines year by year until it reaches zero—would provide large users of fossil fuels with a flexible way to phase out CO₂ emissions. However, free allowances, offsets that permit emissions by third party reductions⁴, or international trading of allowances, notably with developing countries that have no CO₂ cap, would undermine and defeat the purpose of the system. A measurement-based physical limit, with appropriate enforcement, should be put into place.

A hard cap on CO₂ emissions is recommended for large users of fossil fuels, defined as an annual use of 100 billion British thermal units (Btu) or more—equal to the delivered energy use of about 1,000 households. At this level, users have the financial resources to be able to track the market, make purchases and sales, and evaluate when it is most beneficial to invest in CO₂ reduction technologies relative to purchasing credits. This would cover about two-thirds of fossil fuel use. Private vehicles, residential and small commercial use of natural gas and oil for heating, and other similar small-scale uses would not be covered by the cap. The transition in these areas would be achieved through efficiency standards, tailpipe emissions standards, and other standards set and enforced by federal, state and local governments. Taxes are not envisaged in this study, except possibly on new vehicles that fall far below the average efficiency or emissions standards. The hard cap would decline annually and be set to go to zero before 2060. Acceleration of the schedule would be possible, based on developments in climate impacts and technology.

SEE CARBON-FREE ON PAGE 4, ENDNOTES PAGE 14

RECOMMENDATIONS THE CLEAN DOZEN

The 12 most critical policies that need to be enacted as urgently as possible for achieving a zero-CO₂ economy without nuclear power are as follows.

1. Enact a physical limit of CO₂ emissions for all large users of fossil fuels (a "hard cap") that steadily declines to zero prior to 2060, with the time schedule being assessed periodically for tightening according to climate, technological, and economic developments. The cap should be set at the level of some year prior to 2007, so that early implementers of CO₂ reductions benefit from the setting of the cap. Emission allowances would be sold by the U.S. government for use in the United States only. There would be no free allowances, no offsets and no international sale or purchase of CO₂ allowances. The estimated revenues—approximately \$30 to \$50 billion per year—would be used for demonstration plants, research and development, and worker and community transition.
2. Eliminate all subsidies and tax breaks for fossil fuels and nuclear power (including guarantees for nuclear waste disposal from new power plants, loan guarantees, and subsidized insurance).
3. Eliminate subsidies for biofuels from food crops.
4. Build demonstration plants for key supply technologies, including central station solar thermal with heat storage, large- and intermediate-scale solar photovoltaics, and CO₂ capture in microalgae for liquid fuel production.
5. Leverage federal, state and local purchasing power to create markets for critical advanced technologies, including plug-in hybrids.
6. Ban new coal-fired power plants that do not have carbon storage.
7. Enact at the federal level high efficiency standards for appliances.
8. Enact stringent building efficiency standards at the state and local levels, with federal incentives to adopt them.
9. Enact stringent efficiency standards for vehicles and make plug-in hybrids the standard U.S. government vehicle by 2015.
10. Put in place federal contracting procedures to reward early adopters of CO₂ reductions.
11. Adopt vigorous research, development, and pilot plant construction programs for technologies that could accelerate the elimination of CO₂, such as direct solar hydrogen production (photosynthetic, photoelectrochemical, and other approaches), hot rock geothermal power, and integrated gasification combined cycle plants using biomass with a capacity to sequester the CO₂.
12. Establish a standing committee on Energy and Climate under the U.S. Environmental Protection Agency's Science Advisory Board.

The annual revenues that would be generated by the government from the sale of allowances would be on the order of \$30 billion to \$50 billion per year through most of the period, since the price of CO₂ emission allowances would tend to increase as supply goes down. These revenues would be devoted to ease the transition at all levels – local, state and federal – as well as for demonstration projects and research and development.

Finding 3: A reliable U.S. electricity sector with zero-CO₂ emissions can be achieved without the use of nuclear power or fossil fuels.

The U.S. renewable energy resource base is vast and practically untapped. Available wind energy resources in 12 Midwestern and Rocky Mountain states equal about 2.5 times the entire electricity production of the United States. North Dakota, Texas, Kansas, South Dakota, Montana, and Nebraska each have wind energy potential greater than the electricity produced by all 103 U.S. nuclear power plants. Solar energy resources on just one percent of the area of the United States are about three times as large as wind energy, if production is focused in the high insolation areas in the Southwest and West.

Just the parking lots and rooftops in the United States could provide most of the U.S. electricity supply. This also has the advantage of avoiding the need for transmission line expansion, though some strengthening of the distribution infrastructure may be needed. A start has been made. The U.S. Navy has a 750 kW installation in one of its parking lots in San Diego that provides shaded parking spots for over 400 vehicles, with plenty of room to spare for expansion of electricity generation (see cover photo).

One possible future U.S. electricity grid configuration without coal or nuclear power in the year 2050

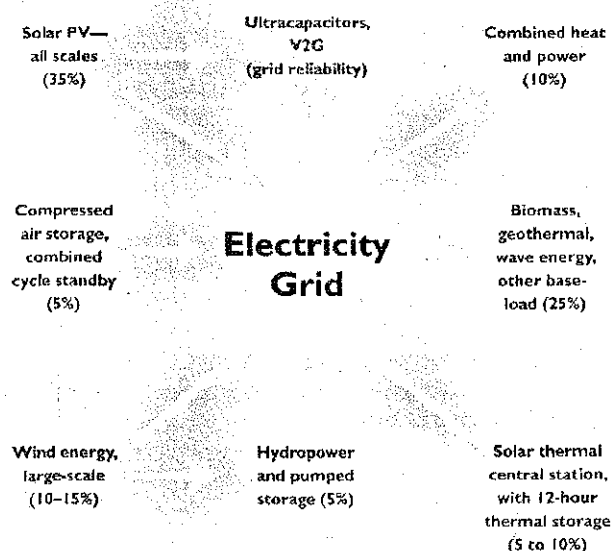


Figure 2

IEER

Complete elimination of CO₂ could occur as early as 2040. Elimination of nuclear power could also occur in that time frame.

Wind energy is already more economical than nuclear power. In the past two years, the costs of solar cells have come down to the point that medium-scale installations, such as the one shown in the cover photo, are economical in sunny areas, since they supply electricity mainly during peak hours.

The main problem with wind and solar energy is intermittency. This can be reduced by integrating wind and solar energy together into the grid – for instance, wind energy is often more plentiful at night. Geographic diversity also reduces the intermittency of each source and for both combined. Integration into the grid of these two sources up to about 15 percent of total generation (not far short of the contribution of nuclear electricity today) can be done without serious cost or technical difficulty with available technology, provided appropriate optimization steps are taken.

Solar and wind should also be combined with hydropower – with the latter being used when the wind generation is low or zero. This is already being done in the Northwest. Conflicts with water releases for fish management can be addressed by combining these three sources with natural gas standby. The high cost of natural gas makes it economical to use combined cycle power plants as standby capacity and spinning reserve for wind rather than for intermediate or baseload generation. In other words, given the high price of natural gas, these plants could be economically idled for some of the time and be available as a complement to wind power. Compressed air can also be used for energy storage in combination with these sources. No new technologies are required for any of these generation or storage methods.

Baseload power can be provided by geothermal and biomass-fueled generating stations. Intermediate loads in the evening can be powered by solar thermal power plants which have a few hours of thermal energy storage built in.

Finally, new batteries can enable plug-in hybrids and electric vehicles owned by fleets or parked in large parking lots to provide relatively cheap storage. Nanotechnology-based lithium ion batteries, which Altairmano has begun to produce, can be deep discharged far more times than needed simply to operate the vehicle over its lifetime (10,000 to 15,000 times compared to about 2,000 times respectively).

Since the performance of the battery is far in excess of the cycles of charging and discharging needed for the vehicle itself, vehicular batteries could become a very low-cost source of electricity storage that can be used in a vehicle-to-grid (V2G) system. In such a system, parked cars would be connected to the grid and charged and discharged

SEE **CARBON-FREE** ON PAGE 5, ENDNOTES PAGE 14

according to the state of the requirements of the grid and the charge of the battery in the vehicle. Communications technology to accomplish this via wires or wireless means is already commercial. A small fraction of the total number of road vehicles (several percent) could provide sufficient backup capacity to stabilize a well designed electricity grid based on renewable energy sources (including biomass and geothermal).

Figure 2 on page 4 shows one possible configuration of the electric power grid. A large amount of standby power is made available. This allows a combination of wind and solar electricity to supply half or more of the electricity without affecting reliability. Most of the standby power would be supplied by stationary storage and/or V2G and by combined cycle power plants for which the fuel is derived from biomass. Additional storage would be provided by thermal storage associated with central station solar thermal plants. Hydropower use would be optimized with the other sources of storage and standby capacity. Wind energy can also be complemented by compressed air storage, with the compressed air being used to reduce methane consumption in combined cycle power plants.

With the right combination of technologies, it is likely that even the use of coal can be phased out, along with nuclear electricity. However, we recognize that the particular technologies that are on the cutting edge today may not develop as now appears likely. It therefore appears prudent to have a backup strategy. The carbon dioxide from coal-fired power plants can be captured at moderate cost if the plants are used with a technology called integrated

gasification combined cycle (IGCC). Carbon capture and sequestration may also be needed for removing CO₂ from the atmosphere via biomass should that be necessary.⁵

The tables on pages 8–10 provide the details and estimated technological schedules along with some cost notes for key components of the IEER reference scenario. The IEER reference scenario describes the overall combinations of technologies and policies that would enable the achievement of a zero-CO₂ economy without any fossil fuels or nuclear power by 2050. We recommend that new coal-fired power plants without carbon capture be banned because constructing new plants at this stage would create pressures to increase CO₂ emission allowances and/or higher costs for capturing the CO₂ later.

Complete elimination of CO₂ could occur as early as 2040. Elimination of nuclear power could also occur in that time frame. An early elimination of CO₂ emissions and nuclear power depends on technological breakthroughs, for instance in efficient solar hydrogen production. If there are major obstacles in the technological assumptions – for instance, if V2G cannot be implemented in the time frame anticipated here (on a large scale after about 15 to 20 years) – then technologies such as co-firing of natural gas with biomass or even some coal with biomass and CO₂ sequestration may be needed. In that case, a zero-CO₂ economy may be delayed to about 2060.

Figure 3 below shows the delivered energy to end uses in the IEER reference scenario (losses in electricity and biofuels production are not included), indicating the approximate pattern of phasing in new fuels and phasing out fossil fuels and nuclear power. It also shows the role of

SEE **CARBON-FREE** ON PAGE 6, ENDNOTES PAGE 14

Delivered Energy, IEER Reference Scenario

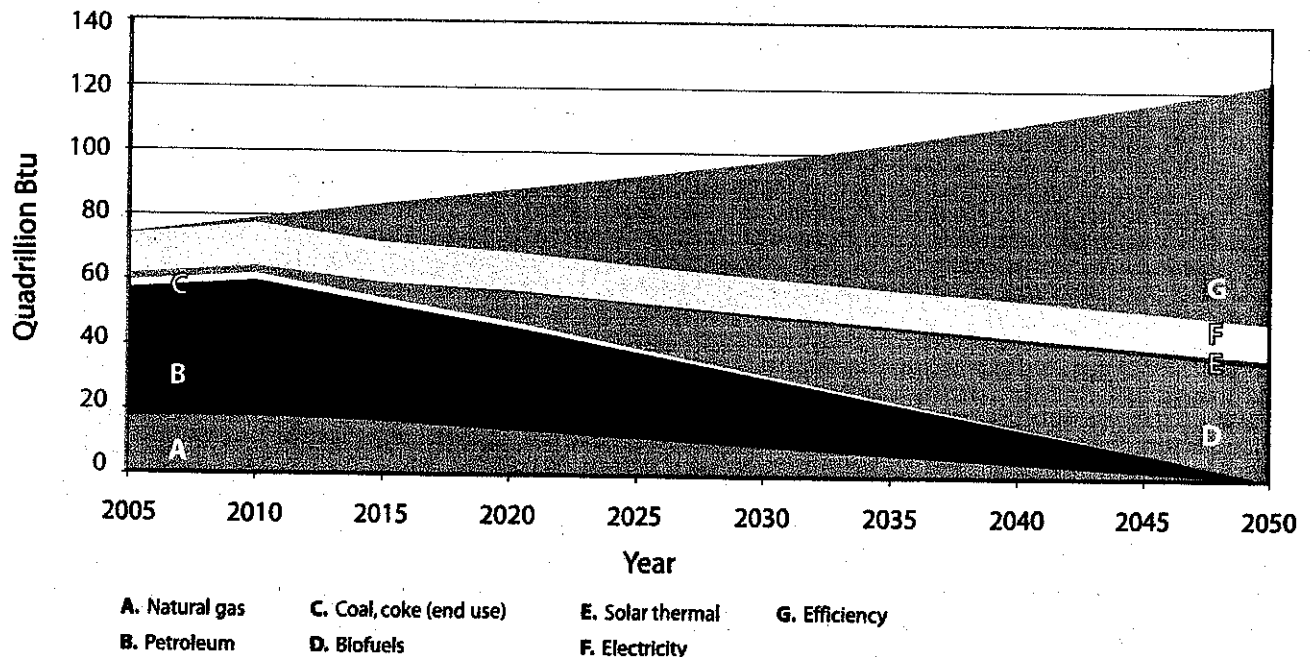


Figure 3

IEER

energy efficiency relative to a business-as-usual approach. The reference scenario envisages a zero-CO₂ non-nuclear economy by 2050.

Figure 4 below shows the corresponding structure of electricity production. The slight decreases followed by increases reflect the faster increase in efficiency envisioned by large-scale introduction of electric cars.

Finding 4: *The use of nuclear power entails risks of nuclear proliferation, terrorism, and serious accidents. It exacerbates the problem of nuclear waste and perpetuates vulnerabilities and insecurities in the energy system that are avoidable.*

Commercial nuclear technology is being promoted as a way to reduce CO₂ emissions, including by the U.S. government. With Russia, the United States has also been promoting a scheme to restrict commercial uranium enrichment and plutonium separation (reprocessing) to the countries that already have it. (These are both processes that can produce nuclear-weapons-usable materials.) This is a transparent attempt to change the Nuclear Non-Proliferation Treaty (NPT) without going through the process of working with the signatories to amend it. The effort will undermine the treaty, which gives non-nuclear parties an "inalienable right" to commercial nuclear technology. In any case, non-nuclear-weapon states are unlikely to go along with the proposed restrictions.

It is not hard to discern that the increasing interest in

nuclear power is at least partly a route to acquiring nuclear weapons capability. For instance, the Gulf Cooperation Council (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates), pointing to Iran and Israel, has stated that it will openly acquire civilian nuclear power technology. In making the announcement, the Saudi Foreign Minister Prince Saud Al-Faisal was quoted in the press as saying "It is not a threat....We are doing it openly." He also pointed to Israel's nuclear reactor, used for making plutonium for its nuclear arsenal, as the "original sin." At the same time he urged that the region be free of nuclear weapons.⁶

Interest in commercial reprocessing may grow as a result of U.S. government policies. The problems of reprocessing are already daunting. For instance, North Korea used a commercial sector power plant and a reprocessing plant to get the plutonium for its nuclear arsenal.

Besides the nuclear weapon states, about three dozen countries, including Iran, Japan, Brazil, Argentina, Egypt, Taiwan, South Korea, and Turkey, have the technological capacity to make nuclear weapons. It is critical for the United States to lead by example and achieve the necessary reductions in CO₂ emissions without resorting to nuclear power. Greater use of nuclear power would convert the problem of nuclear proliferation from one that is difficult today to one that is practically intractable.

Even the present number of nuclear power plants and infrastructure has created tensions between nonproliferation and the rights countries have under the NPT to acquire nuclear technology. Increasing their number

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Electricity Supply, IEER Reference Scenario

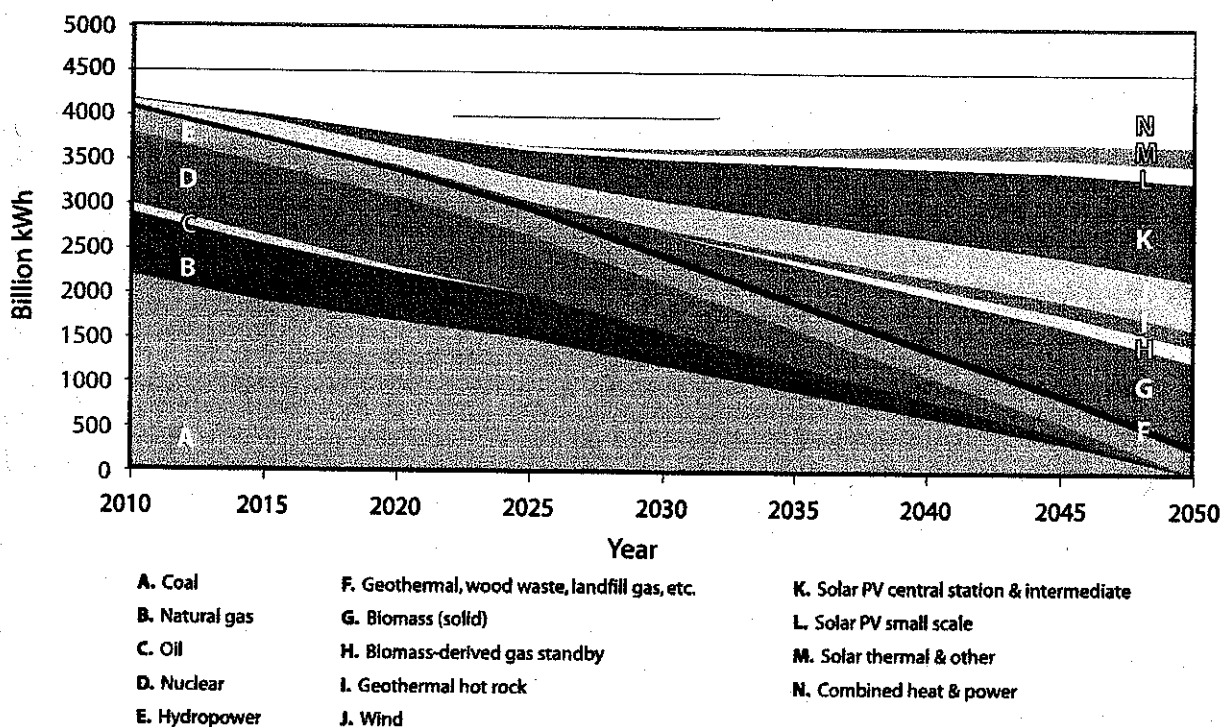


Figure 4

IEER

would require more uranium enrichment plants, when just one such plant in Iran has stoked global political-security tensions to a point that it is a major driver in spot market oil price fluctuations. In addition, there are terrorism risks, since power plants are announced terrorist targets. It hardly appears advisable to increase the number of targets.

The nuclear waste problem has resisted solution. Increasing the number of power plants would only compound the problem. In the United States, it would likely create the need for a second repository, and possibly a third, even though the first, at Yucca Mountain in Nevada, is in deep trouble. No country has so far been able to address the significant long-term health, environmental and safety problems associated with spent fuel or high level waste disposal, even as official assessments of the risk of harm from exposure to radiation continue to increase.⁷

Finally, since the early 1980s, Wall Street has been, and remains, skeptical of nuclear power due to its expense and risk. That is why, more than half a century after then-Chairman of the Atomic Energy Commission, Lewis Strauss,

Wall Street has been, and remains,
skeptical of nuclear power due to its
expense and risk.

proclaimed that nuclear power would be "too cheap to meter," the industry is still turning to the government for loan guarantees and other subsidies. The insurance side is no better. The very limited insurance that does exist is far short of official estimates of damage that would result from the most serious accidents; it is almost all government-provided.

Finding 5: *The use of highly efficient energy technologies and building design, generally available today, can greatly ease the transition to a zero-CO₂ economy and reduce its cost. A two percent annual increase in efficiency per unit of Gross Domestic Product relative to recent trends would result in a one percent decline in energy use per year, while providing three percent GDP annual growth. This is well within the capacity of available technological performance.*

Before the first energy crisis in 1973, it was generally accepted that growth in energy use and economic growth, as expressed by Gross Domestic Product (GDP), went hand in hand. But soon after, the U.S. energy picture changed radically and economic growth was achieved for a decade without energy growth.

Since the mid-1990s, the rate of energy growth has been about two percent less than the rate of GDP growth, despite the lack of national policies to greatly increase energy efficiency. For instance, residential and commercial buildings can be built with just one-third to one-tenth of the present-day average energy use per square foot with existing technology. As another example, we note that

industrial energy use in the United States has stayed about the same since the mid-1970s, even as production has increased.

Our research indicates that annual use of delivered energy (that is, excluding energy losses in electricity and biofuels production) can be reduced by about one percent per year while maintaining the economic growth assumed in official energy projections.

Finding 6: *Biofuels, broadly defined, could be crucial to the transition to a zero-CO₂ economy without serious environmental side effects or, alternatively, they could produce considerable collateral damage or even be very harmful to the environment and increase greenhouse gas emissions. The outcome will depend essentially on policy choices, incentives, and research and development, both public and private.*

Food crop-based biodiesel and ethanol can create and are creating social, economic, and environmental harm, including high food prices, pressure on land used by the poor in developing countries for subsistence farming or grazing, and emissions of greenhouse gases that largely or completely negate the effect of using the solar energy embodied in the biofuels. While they can reduce imports of petroleum, ethanol from corn and biodiesel from palm oil are two prominent examples of damaging biofuel approaches that have already created such problems even at moderate levels of production.

For instance, in the name of renewable energy, the use of palm oil production for European biodiesel use has worsened the problem of CO₂ emissions due to fires in peat bogs that are being destroyed in Indonesia, where much of the palm oil is produced. Rapid increases in ethanol from corn are already partly responsible for fueling increases in tortilla prices in Mexico. Further, while ethanol from corn would reduce petroleum imports, its impact on reducing greenhouse gas emissions would be small at best due to energy intensity of both corn and ethanol production, as well as the use of large amounts of artificial fertilizers, which also result in emissions of other greenhouse gases (notably nitrous oxide). All subsidies for fuels derived from food crops should be eliminated.

In contrast, biomass that has high efficiency solar energy capture (~five percent), such as microalgae grown in a high-CO₂ environment, can form a large part of the energy supply both for electricity production and for providing liquid and gaseous fuels for transport and industry. Microalgae have been demonstrated to capture over 80 percent of the daytime CO₂ emissions from power plants and can be used to produce up to 10,000 gallons of liquid fuel per acre per year. Some aquatic plants, such as water hyacinths, have similar efficiency of solar energy capture and can be grown in wastewater as part of combined water treatment and energy production systems.

Figures 5 and 6 on page 11 show two critical biomass examples that have the potential for about 5 percent solar energy capture – about ten times that of the corn plant, including the grain and the crop residues. The NRG Energy

TABLE 3: TECHNOLOGY ROADMAP TO 2025—SUPPLY & STORAGE TECHNOLOGIES

Technology	Status	Deployable for large-scale use	Next steps	CO ₂ abatement cost; obstacles; comments
Solar PV—intermediate-scale	Near commercial with time-of-use pricing	2010 to 2015	Orders from industry and government; time-of-use electricity pricing	\$10 to \$30 per metric ton; no storage; lack of large-scale PV manufacturing (~1 GW/yr/plant); some manufacturing technology development needed.
Solar PV—large-scale	Near commercial	2015 to 2020	Large-scale demonstration with transmission infrastructure, ~5,000 MW by 2015–2020	\$20 to \$50 per metric ton; no storage; transmission infrastructure may be needed in some cases.
Concentrating solar thermal power plants	Near commercial; storage demonstration needed	2015 to 2020	~3,000 to 5,000 MW needed to stimulate demand and demonstrate 12 hour storage, by 2020	\$20 to \$30 per metric ton in the Southwest. Lack of demand main problem.
Microalgae CO ₂ capture and liquid fuel production	Technology developed, pilot-scale plants being built	2015	Large-scale demonstrations—1,000 to 2,000 MW by 2012; nighttime CO ₂ storage and daytime CO ₂ capture pilot plants by 2012. Large-scale implementation thereafter. Demonstration plants for liquid fuel production: 2008–2015	Zero to negative at oil prices above \$30 per metric ton or so for daytime capture; nighttime capture remains to be characterized. Liquid fuel potential: 5,000 to 10,000 gallons per acre (compared to 650 for palm oil).
Wind power—large-scale, land-based	Commercial	Already being used	Transmission infrastructure and rules need to be addressed; optimize operation with existing natural gas combined cycle and hydropower plants	Negative to \$46 per metric ton for operation with combined cycle standby. Areas of high wind are not near populations. Transmission development needed.
Solar PV—intermediate storage	Advanced batteries and ultracapacitors are still high-cost	~2020	Demonstration of vehicle-to-grid using stationary storage (ultracapacitors and lithium-ion nanotechnology batteries)—several ~1 MW-scale parking lot installations	Five-fold cost reduction in ultracapacitors and lithium ion batteries needed. Main problems: lack of large-scale manufacturing and some manufacturing technology development needed.
Solar PV—intermediate scale with Vehicle-to-Grid	Planning stage only. Technology components available. Integration needed.	~2020 to 2025	By 2015, several 5,000 to 10,000 vehicle demonstration V2G technology	V2G could reduce the cost of solar PV electricity storage from several cents to possibly ~1 cent per kWh.
Biomass IGCC	Early demonstration stage	~2020	Pilot- and intermediate-scale plants (few MW to 100 MW) with various kinds of biomass (microalgae, aquatic plants), 2015 to 2020	Baseload power:
High solar energy capture aquatic biomass	Experience largely in the context of wastewater treatment; some laboratory and pilot plant data	~2020	2010 to 2015 pilot plant evaluations for liquid fuel and methane production with and without connection to wastewater treatment	May be comparable to microalgae biofuels production. 50 to 100 metric tons per acre.

TABLE 3 (continued)

Technology	Status	Deployable for large-scale use	Next steps	CO ₂ abatement cost; obstacles; comments
Hot rock geothermal energy	Concept demonstrated; technology development remains	2025?	Build pilot and demonstration plants: 2015–2020 period	Baseload power.
Wave energy	Concepts demonstrated	2020 or 2025?	Pilot and demonstration plants needed	Possible baseload power.
Photolytic hydrogen	Laboratory development	Unknown—possibly 2020 or 2025	Significantly increased R&D funding, with goal of 2015 pilot plants	Potential for high solar energy capture. Could be a key to overcoming high land area requirements of most biofuels.
Photoelectro-chemical hydrogen	Concept demonstrated; technology development remains	Possibly 2020 or 2025	Significantly increased R&D funding, with goal of 2015 pilot plants	High solar energy capture. Could be a key to overcoming problems posed by agricultural biofuels (including crop residues).
Advanced batteries	Nanotechnology lithium ion batteries; early commercial stage with subsidies	2015	Independent safety certification (2007?); large-scale manufacturing plants	Large-scale manufacturing to reduce costs. Could be the key to low-cost V2G technology.
Carbon sequestration	Technology demonstrated in context other than power plants	Unknown. Possibly 15 to 20 years	Long-term leakage tests. Demonstration project ~2015 to 2020	For use with biomass, plus back-up, if coal is needed.
Ultracapacitors	Commercial in certain applications but not for large-scale energy storage	2015 to 2020?	Demonstration test with intermediate-scale solar PV. Demonstrate with plug-in hybrid as a complement to battery operation for stop-and-start power	Complements and tests V2G technology. About a five-fold cost reduction needed for cost to be ~\$50/metric ton CO ₂ . Lower CO ₂ price with time-of-use rates.
Nanocapacitors	Laboratory testing of the concepts	Unknown.	Complete laboratory work and demonstrate the approach	Has the potential to reduce costs of stationary electricity storage and take ultracapacitor technology to the next step.
Electrolytic hydrogen production	Technology demonstrated	Depends on efficiency improvements and infrastructure development	Demonstration plant with compressed hydrogen vehicles needed ~2015 to 2020	Could be used in conjunction with off-peak wind power.

TABLE 4: TECHNOLOGY ROADMAP TO 2025—DEMAND SIDE TECHNOLOGIES

Technology	Status	Deployable for large-scale use	Next steps	CO ₂ price; obstacles; comments
Efficient gasoline and diesel passenger vehicles	Commercial to ~40 miles per gallon or more	Being used	Efficiency standards needed	Efficiency depends on the vehicle. Can be much higher.
Plug-in hybrid vehicles	Technology has been demonstrated	2010	Efficiency standards, government and corporate orders for vehicles	Large-scale battery manufacturing needed to reduce lithium ion battery cost by about a factor of five.
Electric cars	Technology with ~200 mile range has been demonstrated; low volume commercial production in 2007 (sports car and pickup truck)	2015 to 2020	Safety testing, recycling infrastructure for battery materials, large-scale orders, solar PV-V2G demonstration	One of the keys to reducing the need for biofuels and increasing solar and wind power components.
Internal combustion hydrogen vehicles	Technology demonstrated	Depends on infrastructure development	10,000 psi cylinder development and testing of vehicles. Demonstration project.	
Biofuels for aircraft	Various fuels being tested	2020?	Fuel development, safety testing, emissions testing	
Hydrogen-fuel aircraft	Technology has been demonstrated	2030?	Aircraft design, safety testing, infrastructure demonstration	In combination with solar hydrogen production, could reduce need for liquid biofuels.
Building design	Commercial, well known	Already being used	Building standards, dissemination of knowledge, elimination of economic disconnect between building developers and users	Residential and commercial building energy use per square foot can be reduced 60 to 80 percent with existing technology and known approaches. CO ₂ price, negative to \$50 per metric ton.
Geothermal heat pumps	Commercial	Already being used	Building standards that specify performance will increase its use	Suitable in many areas; mainly for new construction.
Combined heat and power (CHP), commercial buildings and industry	Commercial	Already being used	Building performance standards and CO ₂ cap will increase use	CO ₂ price negative to <\$30 per metric ton in many circumstances.
Micro-CHP	Semi-commercial	Already being used	Building performance standards will increase use	
Compact fluorescent lighting (CFL)	Commercial	Being used currently	Appliance and building regulations needed	Negative CO ₂ price. Mercury impact of disposal needs to be addressed.
Hybrid solar light-pipe and CFL	Technology demonstrated; beta-testing being done in commercial establishments	2012 to 2015?	Government and commercial sector orders	Solar concentrators focus light indoors; work in conjunction with CFL. Five-fold cost reduction needed.
Industrial sector: examples of technologies and management approaches: alternatives to distillation, steam system management, CHP, new materials, improved proportion of first pass production	Constant development of processes	Various	Hard cap for CO ₂ with annual assured decreases and no free allowances will lead to increase in efficiency	Variable. Negative to possibly \$50 per metric ton, possibly more in some cases. Great potential for economical increases in efficiency exists at present costs, since energy costs have gone up suddenly. Successful reductions of energy use indicate that overall cost will be modest, with possible reduction in net cost of energy services.

coal-fired power plant in Louisiana shown in Figure 5 is being used by GreenFuel Technologies Corporation for field tests. The plant is a potential site for a commercial-scale algae bioreactor system that would recycle the plant's CO₂ emissions into biodiesel or ethanol.

Water hyacinths, shown in Figure 6, have been used to clean up wastewater because they grow rapidly and absorb large amounts of nutrients. Their productivity in tropical and subtropical climates is comparable to microalgae – up to 250 metric tons per hectare per year. They can be used as the biomass feedstock for producing liquid and gaseous fuels.

Prairie grasses have medium productivity, but can be grown on marginal lands in ways that allow carbon storage in the soil. This approach can therefore be used both to produce fuel renewably and to remove CO₂ from the atmosphere.

Finally, solar energy can be used to produce hydrogen; this could be very promising for a transition to hydrogen as a major energy source. Techniques include photoelectrochemical hydrogen production using devices much like solar cells, high-temperature, solar-energy-driven splitting of water into hydrogen and oxygen, and conversion of biomass into carbon monoxide and hydrogen in a gasification plant. Tailored algae within a highly controlled environment and fermentation of biomass can also be used to produce hydrogen. In some approaches, energy, food, and pharmaceuticals can be produced simultaneously. Progress has been far slower than it could be for lack of money. Figure 7 on page 12 shows direct hydrogen production from sunlight using algae deprived of sulfur in their diet.

Finding 7: Much of the reduction in CO₂ emissions can be achieved without incurring any cost penalties (as, for instance, with efficient lighting and refrigerators). The cost of eliminating the rest of CO₂ emissions due to fossil fuel use is likely to be in the range of \$10 to \$30 per metric ton of CO₂.

Operating demonstration algae bioreactor at a coal-fired power plant in Louisiana

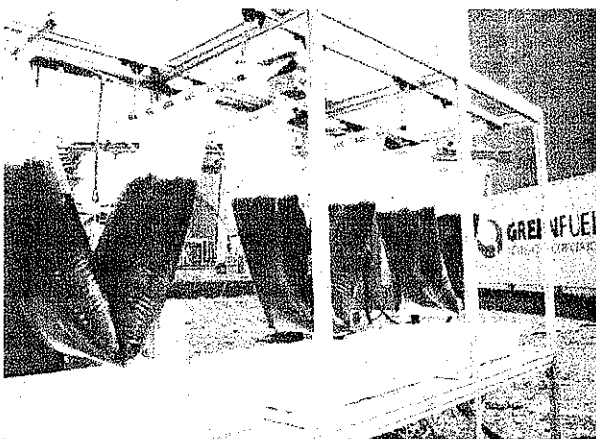


Figure 5 Courtesy Greenfuel Technologies Corporation

Water hyacinths can yield up to 250 metric tons per hectare in warm climates



Figure 6 Courtesy Center for Aquatic and Invasive Plants, Institute of Food and Agricultural Sciences, University of Florida

Table 1 on page 12 shows the estimated costs of eliminating CO₂ from the electricity sector using various approaches. It is based on 2004 costs of energy. At 2007 prices (about \$8 per million Btu of natural gas and almost 9 cents per kilowatt-hour (kWh) electricity, averaged over all sectors) the costs would be lower.

Further, the impact of increases in costs of CO₂ abatement on the total cost of energy services is low enough that the overall share of GDP devoted to such services would remain at about the present level of about 8 percent or perhaps decline. It has varied mainly between 8 and 14 percent since 1970, hitting a peak in 1980. It dropped briefly to about 6 percent in the late 1990s when oil prices tumbled steeply, hitting a low of about \$12 per barrel in 1998.

Table 2 on page 12 shows the total estimated annual energy and investment costs for the residential and commercial sectors in terms of GDP impact. The lower energy use per house and per square foot, higher needed investment, and somewhat higher anticipated costs of electricity and fuels under the IEER reference scenario are taken into account. The net estimated GDP impact of reducing residential and commercial sector energy use by efficiency improvements and converting entirely to renewable energy sources is small and well within the range of the uncertainties in the calculations.

The total GDP for energy services in all sectors under the IEER reference scenario is estimated to remain at about 8 percent or less. For an individual new home owner, the net increased cost, including increased mortgage payments, would be between about \$20 and \$100 per month; the latter is less than 0.7 percent of projected median household income in 2050.

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**TABLE 1: SUMMARY OF COSTS FOR CO₂ ABATEMENT (AND IMPLICIT PRICE OF CO₂ EMISSION ALLOWANCES)—ELECTRICITY SECTOR
(BASED ON 2004 COSTS OF ENERGY)**

CO ₂ source	Abatement method	Phasing	Cost per metric ton CO ₂ , \$	Comments
Pulverized coal	Off-peak wind energy	Short-term	A few dollars to \$15	Based on off-peak marginal cost of coal.
Pulverized coal	Capture in microalgae	Short- and medium-term	Zero to negative	Assuming price of petroleum is >\$30 per barrel.
Pulverized coal	Wind power with natural gas standby	Medium- and long-term	Negative to \$46	Combined cycle plant idled to provide standby. Highest cost at lowest gas price: \$4 per million Btu.
Pulverized coal	Nuclear power	Medium- to long-term	\$20 to \$50	Unlikely to be economical compared to wind with natural gas standby.
Pulverized coal	Integrated Gasification Combined Cycle (IGCC) with sequestration	Long-term	\$10 to \$40 or more	Many uncertainties in the estimate at present. Technology development remains.
Natural gas standby component of wind	Electric vehicle-to-grid	Long-term	Less than \$26	Technology development remains. Estimate uncertain. Long-term natural gas price: \$6.50 per million Btu or more.

Notes:

1. Heat rate for pulverized coal = 10,000 Btu/kWh; for natural gas combined cycle = 7,000 Btu/kWh.
2. Wind-generated electricity costs = 5 cents per kWh; pulverized coal = 4 cents per kWh; nuclear = 6 to 9 cents per kWh.
3. Petroleum costs \$30 per barrel or more.
4. CO₂ costs associated with wind energy related items can be reduced by optimized deployment of solar and wind together.

TABLE 2: ANNUAL RESIDENTIAL (R) AND COMMERCIAL (C) ENERGY AND INVESTMENT COSTS IN 2050, IN BILLIONS OF CONSTANT 2005 DOLLARS

Item	IEER Reference Scenario	Business-as-Usual Scenario
R + C Electricity	\$326	\$442
R + C Fuel	\$150	\$247
Sub-total energy cost	\$476	\$689
Added annual investment for efficiency	\$205	\$0
Total GDP-basis amount (rounded)	\$681	\$689
GDP in 2050	\$40,000	\$40,000
GDP fraction: residential and commercial energy services	1.70%	1.72%

Notes:

1. Business-as-Usual (BAU) fuel and electricity prices: about \$12 per million Btu and 9.6 cents per kWh. IEER prices: \$20 per million Btu and 14 cents per kWh respectively. BAU electricity price is from January 2006.
2. Added efficiency investments: existing residences: \$20,000 per residence each time, assumed to occur in one of every three sales of existing buildings between 2010 and 2050; new = \$10 per square foot (about \$20,000 per house, approximate LEED-certified house added cost); plus cost of replacing appliances every 15 years with then-prevailing advanced appliances. Investments for solar thermal heating, combined heat and power, and geothermal heat pumps added to these figures for the proportion of residential area using them. LEED stands for Leadership in Energy and Environmental Design; it is a building certification program.
3. Commercial efficiency investments: \$10 per square foot; this is more than examples of platinum level LEED investment. Investments for solar thermal heating, combined heat and power, and geothermal heat pumps have been added to these figures.
4. GDP = consumption expenditures + investment + government spending (on goods and services) + exports – imports.

Direct Solar Production of Hydrogen Using Algae

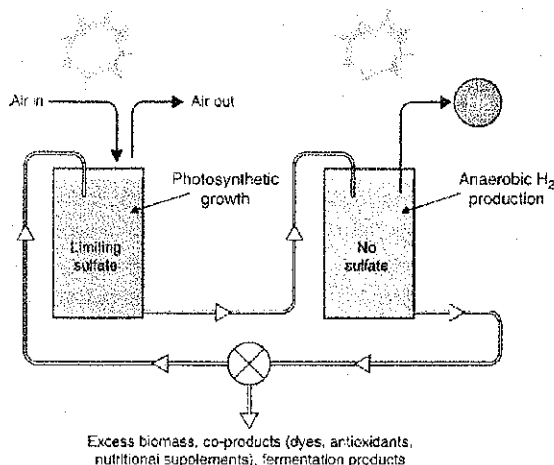
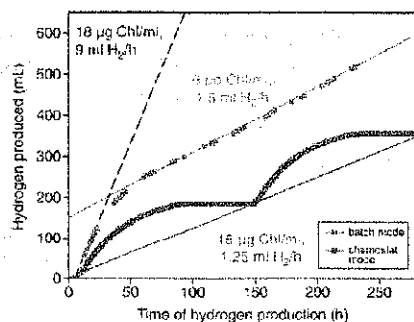


Figure 7 This diagram/graph was developed by the National Renewable Energy Laboratory for the U.S. Department of Energy.

Note: In the "batch mode" the production is stopped periodically to replenish the nutrients. In the "chemostat mode" nutrients are supplied continuously to maintain production. "Chl" stands for chlorophyll.

CARBON-FREE FROM PAGE 11

Finding 8: The transition to a zero-CO₂ system can be made in a manner compatible with local economic development in areas that now produce fossil fuels.

Fossil fuels are mainly produced today in the Appalachian region, in the Southwest and West and some parts of the Midwest and Rocky Mountain states. These areas are also well-endowed with the main renewable energy resources—solar and wind. Federal, state and regional policies, designed to help workers and communities transition to new industries, therefore appear to be possible without more major physical movement or disruption of populations than has occurred in post-World War II United States. It is recognized that much of that movement has been due to dislocation and shutdown of industries, which causes significant hardship to communities and workers. Some of the resources raised by the sale of CO₂ allowances should be devoted to reducing this disruption. For instance, the use of CO₂ capture technologies, notably microalgae CO₂ capture from existing fossil fuel plants, can create new industries and jobs in the very regions where the phaseout of fossil fuels would have the greatest negative economic impact. Public policy and direction of financial resources can help ensure that new energy sector jobs that pay well are created in those communities.

ANSWERS TO ATOMIC PUZZLER, SDA VOL. 14, NO. 4

Calculating CO₂ Emissions from a Natural Gas Fired Plant

- 36,410 Btu per cubic meter \times 1055 joules per Btu = 38,410,000 joules per cubic meter = 3.841×10^7 joules per cubic meter
- 1 kilowatt-hour = 1,000 joules per second per kilowatt \times 3600 seconds per hour = 3,600,000 joules per kilowatt-hour = 3.6×10^6 joules per kilowatt-hour
- 3.841×10^7 joules per cubic meter / 3.6×10^6 joules per kilowatt-hour = 10.67 kilowatt-hours (thermal) per cubic meter
- 800 grams = 800/1000 kilograms = 0.8 kilograms \rightarrow 10.67 kilowatt-hours per cubic meter / 0.8 kilograms per cubic meter = 13.34 kilowatt-hours (thermal) per kilogram
- System efficiency from thermal to electrical energy = 50% = 0.50

Thermal output per kilogram of natural gas = 13.34 kilowatt-hours (thermal)

Electrical output per kilogram of natural gas = 13.34 kilowatt-hours (thermal) \times 0.50 = 6.67 kilowatt-hours (electrical) per kilogram of natural gas

Kilograms of natural gas per kilowatt-hour of electricity = $1/6.67 = 0.150$ kilograms per kilowatt-hour of electricity

- 0.1500 kilograms of natural gas per kilowatt-hour of electricity \times 0.734 kilograms carbon per kilogram of natural gas = 0.110 kilograms of carbon per kilowatt-hour of electricity
- 0.110 kilograms of carbon per kilowatt-hour of electricity \times 3.67 kilograms of CO₂ per kilogram of carbon = 0.404 kilograms of CO₂ per kilowatt-hour of electricity

GLOSSARY

Baseload generation: A large-scale power plant designed to generate electricity on a continuous basis.

Biofuel: Fuel derived from biomass.

Biomass: Organic material produced by photosynthesis.

Carbon capture: Capture of carbon dioxide when fuels containing carbon are burned for their energy.

Carbon sequestration: Deep geologic storage of carbon for long periods (thousands of years) to prevent it from entering the atmosphere.

CFL: Compact fluorescent lamp, which is a high-efficiency light bulb.

CHP: Combined heat and power. In this arrangement, some of the energy derived from burning a fuel is used as heat (as for instance in heating buildings or for industrial processes), and some is used for generating electricity.

Combined cycle power plant: Power plant in which the hot gases from the burning of a fuel (usually natural gas) are used to run a gas turbine for generating electricity. The exhaust gas from the turbine is still hot and is used to make steam, which is used to drive a steam turbine, which in turn generates more electricity.

Electrolytic hydrogen production: The use of electricity to separate the hydrogen and oxygen in water.

Geothermal heat pump: A heat pump that uses the relatively constant temperature a few feet below the earth's surface in order to increase the efficiency of the heat pump.

IGCC: Integrated Gasification Combined Cycle plant. This plant gasifies coal or biomass and then uses the gases in a combined cycle power plant.

LEED: Leadership in Energy and Environmental Design -- a rating system used for building efficiency. The platinum level is the highest rating.

Microalgae: Tiny algae that grow in a variety of environments, including salty water.

Nanocapacitor: A capacitor that has the surface area of its electrodes increased greatly by the use of nanotechnology.

Photolytic hydrogen: Hydrogen produced by plants, for instance, algae, in the presence of sunlight.

Photoelectrochemical hydrogen: Hydrogen produced directly using devices similar to some solar photovoltaic cells that generate electricity. In this arrangement, hydrogen is produced instead of electricity.

Pumped storage: Using electricity at off-peak times to pump water into a reservoir and then using a hydroelectric power plant to generate electricity with the stored water during peak times (or, when used with wind energy, when the wind is not blowing).

Solar light pipe: A fiber optic cable that conveys light from the sun along its length without leaking it out of the sides, much like a wire carries electricity. It can be used to light the interiors of buildings during the daytime.

Solar PV: Solar photovoltaic cells -- devices that turn incident sunlight into electricity.

Solar thermal power plant: A power plant that uses reflectors to concentrate solar energy and heat liquids that are then used to produce steam and generate electricity.

Spinning reserve: The capacity of electric power plants that are kept switched on ("spinning") but idle in order to be able to meet sudden increases in electricity demand.

Standby capacity: Power plants that are kept on standby to meet increases in electric demand.

Ultracapacitor: A capacitor that can store much more electricity per unit volume than normal capacitors.

V2G: Vehicle to grid system. Parked cars are connected to the grid. When the charge on the batteries is low, the grid recharges them. When the charge is sufficient and the grid requires electricity, a signal from the grid enables the battery to supply electricity to the grid.

Endnotes

1. This issue of SDA is a summary of a report of the same title that will be web-published in August 2007 and published as a book in October 2007 by RDR Books. References can be found in the report at www.ieer.org/carbonfree. The study is a joint project of the Nuclear Policy Research Institute and the Institute for Energy and Environmental Research. For their support of this project, NPRI and IEER wish to thank The Park Foundation, The Lear Family Foundation, The Lintilhac Foundation, and many individual donors who wish to remain anonymous.
2. On the Internet at www.supremecourt.us/opinions/06pdf/05-1120.pdf.
3. Based on a global population of 9.1 billion and a U.S. population of 420 million in 2050.
4. Offsets allow a purchaser to continue emitting CO₂ while paying for reductions in CO₂ by the party from whom the offsets are purchased. These may or may not result in actual CO₂ reductions. Even when they do, the emissions may be immediate while reductions may be long-term. Verification is difficult and expensive.
5. Integrated gasification of coal works as follows: Coal is reacted with steam, which yields a mixture of hydrogen and carbon monoxide. When burned, this yields CO₂ and water. The process can result in removal of heavy metals prior to combustion; nearly all the sulfur in the coal can also be captured, preventing almost all sulfur dioxide emissions. When nearly pure oxygen is used for combustion, capture of CO₂ becomes far less expensive. The CO₂ can then be injected into a deep geologic formation. Since biomass draws CO₂ from the atmosphere, sequestering CO₂ when biomass is the fuel results in a reduction of atmospheric CO₂, provided the biomass production process does not involve greater CO₂ emissions.
6. Saudi-US Relations Information Service, "27th GCC Supreme Council Summit Wrapup," December 13, 2006, online at www.saudi-us-relations.org/articles/2006/loi/061213-gcc-summit.html. Viewed June 20, 2007.
7. See for instance the report of the National Academy of Sciences, published in 2006, at <http://books.nap.edu/openbook.php?isbn=030909156X>.

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Thanks also to our foundation funders, listed on page 2.

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Thank you very much for your support.

SUMMARY OF MAIN FINDINGS

1. A goal of a zero-CO₂ economy is necessary to minimize harm related to climate change.
2. A hard cap on CO₂ emissions – that is, a fixed emissions limit that declines year by year until it reaches zero – would provide large users of fossil fuels with a flexible way to phase out CO₂ emissions. However, free allowances, offsets that permit emissions by third party reductions, or international trading of allowances, notably with developing countries that have no CO₂ cap, would undermine and defeat the purpose of the system. A measurement-based physical limit, with appropriate enforcement, should be put into place.
3. A reliable U.S. electricity sector with zero-CO₂ emissions can be achieved without the use of nuclear power or fossil fuels.
4. The use of nuclear power entails risks of nuclear proliferation, terrorism, and serious accidents. It exacerbates the problem of nuclear waste and perpetuates vulnerabilities and insecurities in the energy system that are avoidable.
5. The use of highly efficient energy technologies and building design, generally available today, can greatly ease the transition to a zero-CO₂ economy and reduce its cost. A two percent annual increase in efficiency per unit of Gross Domestic Product relative to recent trends would result in a one percent decline in energy use per year, while providing three percent GDP annual growth. This is well within the capacity of available technological performance.
6. Biofuels, broadly defined, could be crucial to the transition to a zero-CO₂ economy without serious environmental side effects or, alternatively, they could produce considerable collateral damage or even be very harmful to the environment and increase greenhouse gas emissions. The outcome will depend essentially on policy choices, incentives, and research and development, both public and private.
7. Much of the reduction in CO₂ emissions can be achieved without incurring any cost penalties (as, for instance, with efficient lighting and refrigerators). The cost of eliminating the rest of CO₂ emissions due to fossil fuel use is likely to be in the range of \$10 to \$30 per metric ton of CO₂.
8. The transition to a zero-CO₂ system can be made in a manner compatible with local economic development in areas that now produce fossil fuels.

From *Carbon-Free and Nuclear-Free: A Roadmap for U.S. Energy Policy*, www.ieer.org/carbonfree/

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DAIRYLAND POWER

COOPERATIVE

TO: Rep. Phil Montgomery, Chair, and
Honorable Members of the Assembly Committee on Energy and Utilities

FROM: Brian Rude

DATE: December 18, 2007

SUBJECT: Support of AB 346, AB 347 and AB 348, Recommendations of
the Joint Legislative Council Special Committee on Nuclear Power


Dairyland Power Cooperative, a generation and transmission cooperative based in La Crosse and serving 600,000 consumers in four states, supports the bills developed by the Joint Legislative Council Special Committee on Nuclear Power, and now introduced as Assembly Bill 346, Assembly Bill 347 and Assembly Bill 348. I served on the Committee representing Wisconsin's electric cooperatives. The study effort was one of the best I have participated in, reflecting Wisconsin's best traditions of evaluating and weighing public policy changes, and the bills before this committee are worthy of your support.

You may be aware that Dairyland is the owner of a closed nuclear reactor located near Genoa, Wisconsin. This plant was built by the federal government as a demonstration project to show the potential to locate nuclear plants in rural areas. The plant, which we purchased from the federal government for \$1, operated successfully from 1967 to 1987. In 1987, because of the relative small size of the plant (50 MW) and increased government regulation, we closed the reactor.

Since that time, the spent fuel has remained on site. There is no federal repository at this time, even though one has been promised to us for many years by Congress. The latest schedule is that a Yucca Mountain repository may open in 2017. Because of politics, we believe that schedule may be difficult, if not impossible, to meet. It currently costs our rural electric consumers \$6 million a year to maintain the minimum workforce necessary to meet federal laws regarding monitoring and securing our spent fuel at our Genoa site. These costs are directly passed on to each of our members. Cooperative members have a great interest in nuclear issues as the result of this situation.

There are three bills that came out of the Special Committee on Nuclear Power. Let me share a few of our comments on each:

- **Assembly Bill 346, repealing the Wisconsin limits on construction of new nuclear** -- at our last annual meeting, a resolution was proposed by our Resolutions Committee in support of new nuclear and in favor of repealing Wisconsin's ban on construction of new nuclear. The resolution was adopted on

A Touchstone Energy® Cooperative 

Page 2

December 18, 2007

an overwhelming voice vote, with only a handful of the 700 delegates voting "nay." Especially given the growing concern about climate change, Wisconsin will need the option of new nuclear in the years ahead. Any nuclear plant proposal would still have to go through the entire regulatory process and stand on its operational and cost merits. We support giving energy companies the option to seek new generation nuclear.

- **Assembly Bill 347, relating to requiring the PSC to investigate future electric supplies after the operating licenses of current nuclear plants expire –** Wisconsin depends heavily on the two operating nuclear facilities in the state, located at Kewaunee and Point Beach. If these plants close in the future, we will need significant alterations in our state's power supply. This legislation codifies the need to evaluate that issue. We believe this is common sense policy, since shutting down our existing plants would require a major new source of energy.
- **Assembly Bill 348, directing the PSC to advocate for Wisconsin on matters relating to interim fuel storage until a permanent repository is built.** State law currently requires the PSC to advocate for ratepayers on a permanent repository project. This law was passed at a time when northern Wisconsin was under consideration as one of the sites for a national repository. Because of the long delay in opening Yucca Mountain, we believe some type of interim storage represents a much more likely opportunity for dealing with the spent fuel issue. The PSC can be an effective advocate for Wisconsin ratepayer concerns by becoming aggressively involved in the interim storage issue, supporting alternatives which might deal with the stranded spent fuel issue facing Dairyland and many other utilities.

Wisconsin, and all other states, faces many difficult planning and supply issues relating to electric energy. Increasing costs of fuel, the need for expanded transmission infrastructure, pending climate change legislation and investment in new generation are all issues we must deal with daily. We believe passage of these three bills makes sense for the state in light of our existing nuclear position and in light of the changing debate on the future of nuclear power.

Please contact me if you have any questions!

Sincerely,

DAIRYLAND POWER COOPERATIVE



Brian D. Rude
Director, External Relations

BDR:mkw

Testimony for Energy and Utilities Committee
in opposition to AB 346
Wisconsin Assembly
December 18, 2007

Chairman Montgomery and Committee members:

I apologize that my holiday schedule has made it too difficult to speak to you in person today on short notice.

Wisconsin law now prohibits construction of new nuclear power stations here as long as there is no licensed facility for permanent disposal of the spent fuel.

If long-term on-site storage of spent fuel were safe, this present restriction wouldn't be worth very much. Is such storage safe? Professor Michael Corradini, who is well-known to this Committee, said in the October 30, 2007 *Milwaukee Journal Sentinel*, "Spent fuel storage at nuclear power plants is demonstrated to be safe and reliable."

Professor Corradini is an expert, a career nuclear engineer. Why not just say that his opinion settles the question?

Because it doesn't, for two principal reasons.

First, uncritical deference to experts is a recipe for disaster. Let me remind you of some recent examples from my own profession, medicine.

The pain reliever Vioxx was licensed by the FDA, an expert body, and prescribed by physicians, another group of experts, to millions before it was taken off the market for deadly side effects. Millions more took post-menopausal estrogen on expert advice that they were protecting their hearts. Now we know otherwise.

Would Professor Corradini tell us engineers are better than that? If he did, it would mark his testimony with a red flag. We all know engineers are capable of spectacular failure in their area of expertise.

In the early years of the space shuttle program, the experts at NASA told us the risk of catastrophic failure was about 1 in 10,000 launches. Unless you still believe that estimate, you understand my point.

Which brings me to the second reason not to rely on Professor Corradini's claim.

The nuclear industry itself knows on-site storage is an unsuitable long-term strategy. That is why government and industry have continued at great expense over many years to struggle with all the technical and societal barriers to opening the Yucca

Mountain site. And remember, if and when Yucca Mountain ever opens, it won't have capacity to take spent fuel from any yet-to-be-built Wisconsin reactors.

Nuclear power stations with years of spent fuel stored on site are ideal targets, worthy of the name "pre-placed radiological weapons for enemy use." Americans, of all people, ought to understand that the lack of a successful attack on one, so far, is no reason to dismiss the possibility when we plan for future electric power sources.

Let's stay out of the business of creating new targets in Wisconsin. And let's be skeptical when experts recommend more of what they do in their own careers.

Chuck Baynton MD in behalf of
Disarmament Committee,
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To: Chairman Phil Montgomery
Members of the Assembly Committee on Energy and Utilities
From: R.J. Pirlot, Director of Legislative Relations
Date: December 18, 2007
Subject: **Support for AB 346, AB 347, and AB 348**

Wisconsin Manufacturers and Commerce (WMC) is the largest representative of Wisconsin employers. Our membership is a broad cross-section of the state's economic activity and our members employ approximately one-quarter of the state's workforce.

WMC supports the legislative recommendations of the Legislative Council Special Committee on Nuclear Power, as embodied in Assembly Bill (AB) 346, AB 347, and AB 348. AB 346 would repeal Wisconsin's virtual moratorium on the construction of new nuclear power plants. AB 347 requires the Wisconsin Public Service Commission (PSC) to investigate ways Wisconsin can replace the electricity generated by its current nuclear power plants, when their operating licenses are expected to expire. AB 348 gives the PSC additional duties to advocate on nuclear waste storage facility matters.

Wisconsin's Virtual Moratorium on New Nuclear Power Plants

Wisconsin virtual moratorium on the construction of new nuclear power plants was enacted in 1983 Wisconsin Act 401. The statute is often referred to as a "moratorium" on new nuclear plant construction because it prohibits the Public Service Commission (PSC) from approving for construction any "nuclear fired large electric generating facility," unless certain conditions are met.

Under the virtual moratorium, the PSC may not certify any new large nuclear-fired electric generating facility unless it finds both of the following:

1. That a federally-licensed facility, or a facility outside the United States if the PSC finds that such foreign facility would meet the public health and welfare requirements of the people of the state, with adequate capacity to dispose of all nuclear waste from all nuclear power plants operating in the state, will be available at which to dispose of the state's spent nuclear fuel.
2. That the proposed nuclear power plant facility is economically advantageous to the people of the state, including consideration of an existing reliable and adequate supply of nuclear fuel, and the costs of construction, operation, decommissioning, and disposal of the nuclear waste to be generated by the facility, along with any other economic factor to be determined by the PSC.

Time to Repeal the Virtual Moratorium on New Nuclear Power Plants

Under an aggressive interpretation of the moratorium statute, the PSC is currently capable of finding that a permanent nuclear waste repository "will be available" to

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adequately meet Wisconsin's spent nuclear fuel storage needs, given the progress made in siting the Yucca Mountain Nuclear Waste Repository site in Nevada (located in Nye County, 100 miles northwest of Las Vegas). A clearer, more unambiguous signal to new nuclear generation investment would be to repeal the moratorium altogether, as AB 346 proposes. Given the current economic and regulatory environment faced by Wisconsin energy providers, WMC supports repeal of Wisconsin's virtual moratorium on new nuclear power plants, subjecting new nuclear power plants to the tough economic and environmental scrutiny afforded other kinds of new power plants.

Nuclear generation has been, and continues to be one of the most reliable sources of electricity for Wisconsin. In recent years, the capacity factors of the Kewaunee and Point Beach units have exceeded 90-95 percent. This has been accomplished while those units have attained very high safety ratings from the Institute of Nuclear Power Operations.

Nuclear power has surpassed coal as a more economic fuel used to produce electricity. According to statistics released by the Nuclear Energy Institute, in recent years, in part due to the efficiency of unit operations noted above, nuclear generation production costs have averaged 1.72 cents per kilowatt hour nationally. This may be compared to national average production costs during the same time periods for coal, at 2.37 cents per kilowatt hour, and natural gas, at 6.75 cents per kilowatt hour. WMC believes that low production costs for electricity are critical in maintaining low rates for all customers. Low rates are crucial in maintaining the competitiveness of Wisconsin's commercial and manufacturing sectors, especially for businesses for which energy is a significant portion of production costs, or costs of goods sold, as it is for the paper manufacturing, plastics and food processing industries.

New nuclear generation technologies present viable investment opportunities, sparking a growing nationwide policy debate concerning nuclear energy. Both General Electric and Westinghouse have accomplished advanced research and development in boiling water and pressurized nuclear power reactors which permit construction of medium scale plants at lower unit construction costs than have been traditionally associated with nuclear generation. The business case for new nuclear generation technologies is more viable in recent years perhaps than it ever has been since Wisconsin's last policy debate concerning nuclear power. As a technological possibility, however, such matters are closed to Wisconsin policymakers so long as the moratorium statute remains law.

Proposed Permanent Spent Nuclear Fuel Waste Repository

The federally-licensed facility noted in the moratorium statute is that envisioned by the federal Nuclear Waste Storage Policy Act of 1982. That act set up a process by which the federal Department of Energy (DOE) would study, test, identify and select a permanent high-level nuclear waste storage facility, and recommend that facility to the President.

The DOE has been studying the Yucca Mountain site intensively since the early 1990s. This stage of the process, which included thermal and geologic testing in its "viability assessment," was completed in the latter half of the 1990s and

finalized in 2001. In 2002, the DOE formally recommended the Yucca Mountain site to the President. The Governor of Nevada formally objected to this recommendation under the 1982 Act, sending the matter to Congress. Congress overrode that objection by joint resolution. Currently, Yucca Mountain remains the recommended site, which has been the subject of a fully prepared DOE environmental impact statement. The Department of Energy is preparing an application to obtain the Nuclear Regulatory Commission license to proceed with construction of the repository.

The PSC, under current law, "shall serve as an advocate on behalf of the citizens of this state before the federal department of energy and other federal agencies on matters related to the long-term disposal of radioactive waste." Under AB 348, the PSC would specifically be charged with representing Wisconsin citizens on issues related to the creation of a federal repository for the long-term storage of radioactive waste.

Wisconsin Businesses Need Access to Affordable, Reliable Electricity

Wisconsin faces several challenges with respect to energy and, ultimately, the state's long-term economic health. Affordable, reliable electricity keeps our stores open, factories running, and payrolls being made. But this most basic component of our economy cannot be taken for granted. Our state's energy use is growing at a rate of between 2.5 percent and 3.5 percent per year, and we now import, over existing power lines, more than 15 percent of our electricity. For most Wisconsin manufacturers, a key issue is maintaining certainty over energy supply reliability, while meeting energy demands in the most efficient and cost-effective manner possible.

Repealing the moratorium statute will have no immediate consequences. In contrast, moratorium repeal will, for the first time in twenty years, expand available electricity generation fuel options, subject to PSC-controlled certification. Policymakers would accordingly be permitted to *consider* nuclear generation among the other options available to serve the current and future load growth among Wisconsin customers. If new or expanded nuclear generation makes sense for Wisconsin, the PSC could, under AB 346, make that determination.

In addition to repealing Wisconsin's virtual moratorium on new nuclear power plants, Wisconsin needs to start looking into how the state's energy needs will be met when the operating licenses of our existing nuclear power plants expire. The operating licenses for our existing nuclear power plants are expected to expire by 2033. AB 347 would require the PSC to undertake such an investigation.

While many, many factors contribute to a good business climate — such as low taxes, a predictable and consistent regulatory climate, reasonable health care costs — no one can argue that access to reliable, competitively-priced electricity is an absolute necessity for our jobs and our economy. Wisconsin, therefore, needs to be able to consider *all* of its energy options, including nuclear.

As such, WMC respectfully requests you support AB 346, AB 347, and AB 348.



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December 18, 2007

To: Assembly Committee on Energy and Utilities

Re: Opposition to AB 346 - repeal of the moratorium on the construction of new nuclear power plants

The League of Women Voters of Wisconsin this year finished a two-year study of Wisconsin's electric energy policy. As part of our effort to be well informed, we attended the meetings of the Legislative Council Special Committee on Nuclear Power. The Council's staff is to be commended for the high quality of information and advice provided to the Committee. We would like to comment on the recommendations the Committee made and the resulting legislation.

The League of Women Voters has long recognized the importance of nuclear power as a valuable resource of electric energy. We also place value on the low level of greenhouse gas emissions from nuclear generation of electricity. However, the league OPPOSES the proposed legislation and offers the following reasons to REJECT the Special Committee's recommendations.

- LWVWI has for decades opposed further licensing and construction of nuclear fission reactors until scientific questions regarding their effects on public health and safety can be resolved. The League affirmed its support of the current moratorium law at our state convention in June because the conditions specified in the law still need to be addressed. Wisconsin is not alone. Twenty other states have moratorium laws with similar conditions.
- Long-term storage of nuclear wastes is among the most troublesome issues to legislators, utilities, regulators, environmentalists, and citizens. The proposed nuclear facility at Yucca Mountain has been under development for over twenty years. It is still uncertain whether the Nuclear Regulatory Commission will license it. If licensed, the most optimistic estimates are that it could accept nuclear wastes by 2017. It then could take 20 years to collect and store the wastes currently stored at individual sites throughout the nation. This is an unacceptable situation, worthy of halting any new construction.
- The very high costs of capital construction, federal/state regulations governing mining site protection and cleanup, storage and transportation assures out-of-state ownership. Two Wisconsin utilities with nuclear power plants have already chosen to sell them to out-of-state corporations due in part to the high costs, continuing financial risks, and adverse public opinion. Wisconsin's regulatory role over out-of-state-owned utilities would be significantly diminished especially in matters of siting, operation, maintenance, retirement, closure, and post-closure security. Further, our experience is that the PSC is more likely than the Nuclear Regulatory Commission to be responsive to concerns of Wisconsin residents.
- Another significant issue is the siting of a nuclear plant. Access to a large body of water is essential, presumably Lake Michigan. This is ironic in light of President Bush having declared it a national treasure in 2004. Subsequently, the Great Lakes-St. Lawrence River Basin Resources Compact was signed by Governor Doyle and four other governors and by premiers of two Canadian provinces for the responsible use and protection of the Great Lakes. We should honor these commitments for the protection of Lake Michigan.

Last month the Midwest Governors Association Energy Summit did not include expanded use of nuclear power in its Energy Security and Climate Stewardship Platform for the Midwest. This was a wise choice, given the serious safety and economic issues that have not been resolved since the moratorium law was passed. We urge you to support the current law and reject AB 346.



MEMORANDUM

December 17, 2007

TO: Wisconsin Assembly Committee on Energy & Utilities

FROM: Jeff Landin, President

SUBJECT: **Wisconsin Paper Council Position on AB-346, AB-347 and AB-348**

The Paper Council provides this memo in support of passage of these three bills which are scheduled for public hearing on December 18, 2007.

The Wisconsin Paper Council is the trade association representing the pulp, paper and allied industry in the state. The paper industry employs approximately 37,500 individuals in Wisconsin each earning, on average, more than \$50,000 annually. Wisconsin has been the nation's leading paper manufacturing state for more than 50 years.

Paper manufacturing is very energy intensive whether the raw material is pulpwood or recycled paper. Papermakers are dependent on affordable, reliable supplies of energy. It is important to the industry's future that we also have access to a diversified range of energy resources to avoid being dependent on a single type of fuel or energy resource or captive to damaging price volatility in wholesale and retail energy markets.

As Wisconsin addresses its need for reliable energy for residential, agricultural, commercial, industrial and municipal customers – and its interest in clean energy to reduce its carbon footprint – nuclear energy needs to be a consideration. Wisconsin's "nuclear moratorium" is a barrier halting meaningful consideration of nuclear power and to a comprehensive discussion of all energy options by legislators, regulators, stakeholders and the public.

Utilities in a number of states, and electricity generators in other nations, are actively debating nuclear power options. It will be poor public policy for Wisconsin not to engage in its own consideration of all energy options, including nuclear. For that to occur AB 346 should receive legislative approval.

Additionally, AB 347 and AB 348, requiring the Public Service Commission to investigate future electric supplies after the operating licenses of nuclear power plants in this state expire; and to advocate on matters related to the centralized interim storage of, and license application for, a federal repository for high-level radioactive waste and transuranic waste, are synergistic companions to AB 346 and also should receive legislative approval.
